SECTION TWO NOVEMBER, 1960

PMI

PHOTO METHODS FOR INDUSTRY

VISUAL COMMUNICATIONS CONGRESS • CHICAGO • DECEMBER 3, 4, 5, 6

REPRODUCTION METHODS

rm

FOR BUSINESS & INDUSTRY

special section

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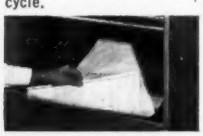
B. Next, operator inserts a sheet of ordinary paper or vellum, or an offset paper master. Insertion starts automatic printing and processing cycle.



C. The first print is automatically delivered in 30 seconds, subsequent prints (of the same or different drawings) every 15 seconds.

Now, you can get a ready-to-use engineering print . . . in seconds and *on ordinary cut-sheet paper* . . . from a microfilm aperture card.

The XeroX® Copyflo® 1824 printer makes 18″ x 24″ prints, or smaller, at an extremely low cost. Also reproduces on vellum or offset paper masters.

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And the quality of reproduction is excellent. The image is sharp black-on-white and won't rub off. There is no odor, no waste, and the paper may be written on with pencil or pen.

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Formerly, such economies . . . from $20,000 to $100,000 annually . . . required a substantial reproduction need to make the system feasible.

Today, however, the Copyflo 1824 printer brings the same proportionate benefits to small-volume users as to large. No need now for vast files of engineering drawings. Microfilm aperture cards take only a fraction of the storage space required for other reproducibles. No more costly waiting for prints. And prints made by a Copyflo 1824 printer are so inexpensive, your engineers can discard them after use.

Write today for 1824 booklet giving full benefits you can expect from a Copyflo 1824 printer. Haloid Xerox Inc., 60 386X Haloid St., Rochester 3, N.Y. Branch offices in principal U.S. and Canadian cities. Overseas: Rank-Xerox Limited, London.

HALOID XEROX®

Get more information. Circle 410, page 47

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Flash-O-Graph concentrated liquid Fixer is now available in the new 5 gallon Cubitainers. For plant operations requiring larger packings than the standard 1-gallon bottles this will be welcome news.

And Flash-O-Graph Hardener is now being packed in cartons of four 120 oz. poly bottles. This permits you to order Flash-O-Graph Fixer and Hardener in the sizes most convenient and economical for your needs. At the same time it gives you full freedom according to your job requirements.

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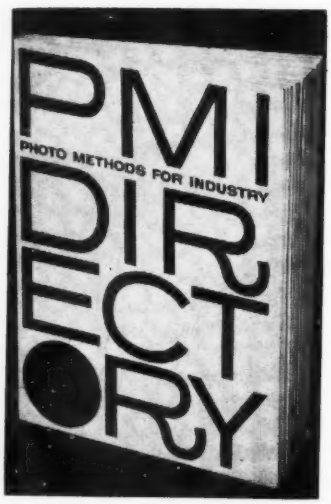

• • The PMI DIRECTORY is the only centralized Reference and Buying Guide for the Inplant Photographer, Reproduction Engineer, Executive Head, and the many Technical and Engineering Personnel Specializing in Photo-and-Repro Methods.

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PMI

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—Mr. Harry Edelmann, President, En-Ser-Co, Inc., Cleveland, Ohio

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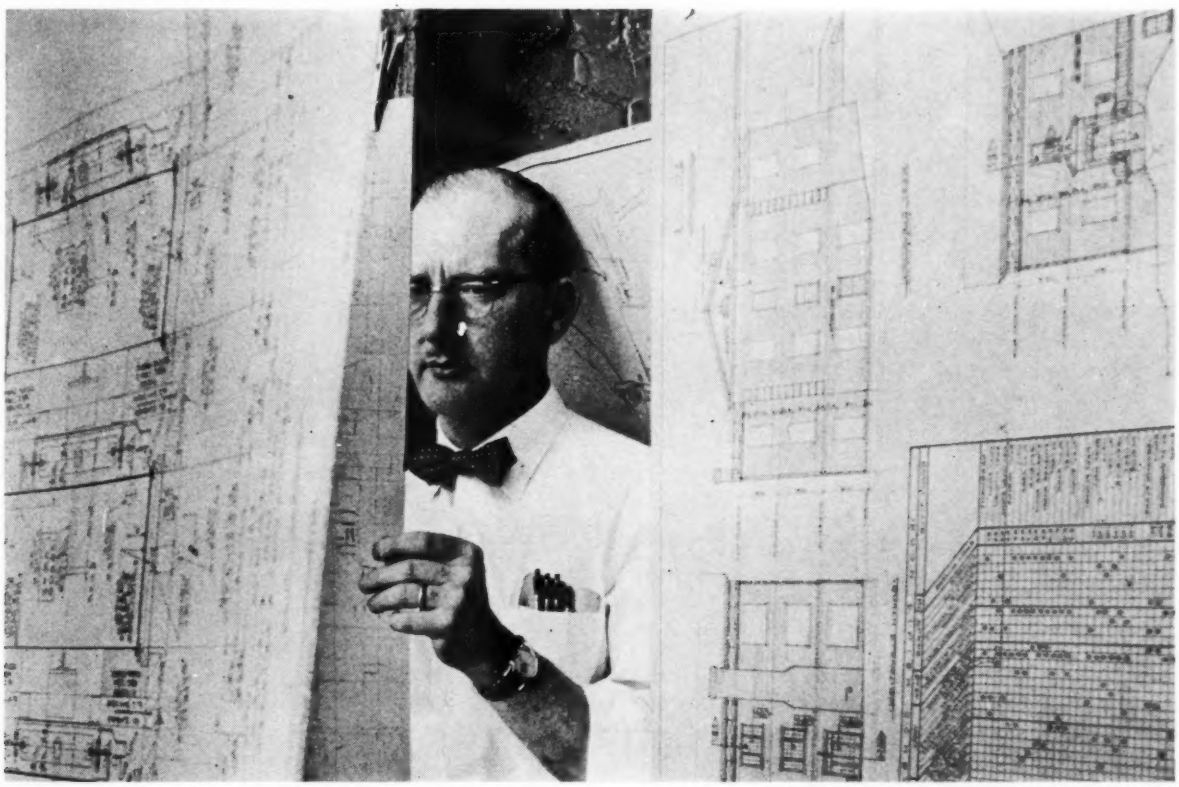
"For example," Mr. Edelmann continues, "we undertook the task of reproducing a set of 60-year-old production plates, containing handwritten copy, after every other method had failed. The plates were badly smudged and smeared. Using CRONAFLEX, we made crisp, sharply-etched reproductions, so legible they looked like ink copies. I'm convinced we couldn't have performed a job like that with any other material!"

Offering a complete range of engineering reproduction services, En-Ser-Co uses CRONAFLEX for the production of everything from plant layout charts and printed circuits to architectural renderings and map reproductions. Concludes Mr. Edelmann: "the consistent quality of CRONAFLEX, coupled with simplified processing and handling ease, permits far better work at savings of 20% or more to our customers."

If photographic versatility, consistent quality and greater end-cost savings are high on *your* list of requirements, there's a CRONAFLEX Engineering Reproduction Film to do the job. For details, just call your local Du Pont Photo Products sales office below.



This advertisement was prepared exclusively by Phototypography.

Mr. Edelmann inspects finished reproductions on CRONAFLEX as they hang on drying lines. "Fast drying time, because of its unique CRONAR® base, is another big advantage of CRONAFLEX," he states.

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Superb, high-contrast emulsions now ON ESTAR BASE

Now you can meet the job at hand with intermediates that are as tough as they come and have exceptionally sharp detail.

Big new plus in these 3 films is Kodak's Estar Base which gives much longer life and greater dimensional stability to reproductions of drawings, maps, documents.

These new Estar Base films are highly translucent for fast "print back". . . have an excellent matte surface on both sides for easier drafting . . . won't turn yellow or become brittle . . . and are resistant to moisture. Available in popular cut-sheet sizes and in rolls up to 52 inches wide.

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1. Kodagraph Autopositive Film, ESTAR BASE
Ideal choice for general reproduction work—gives you same-size positive intermediates directly without a negative step . . . can be exposed and processed in room light. Excellent results from print-through and reflex printing—even when reflexing from metal templates.

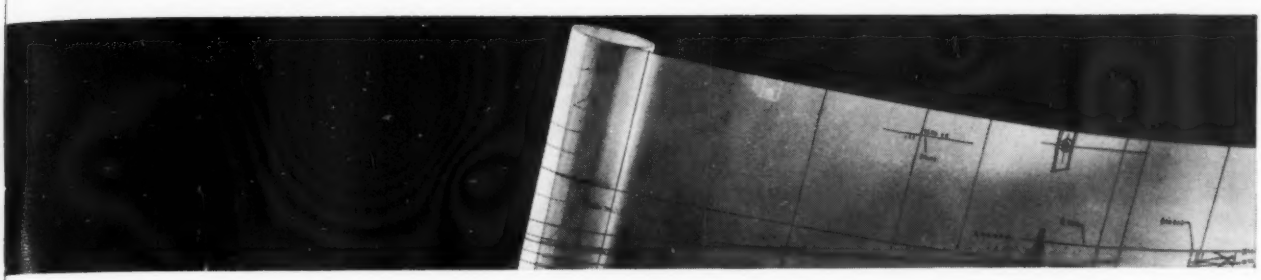
2. Kodagraph Contact Film, ESTAR BASE
Bound to be a darkroom favorite in making same-size reproductions of old or weak line drawings and other documents from film or low-cost paper negatives. Exposures are made with standard contact printers. Processing done with either paper or litho developers. Exceptionally wide latitude of this film all but ends make-overs.

3. Kodagraph Projection Film, ESTAR BASE
Changing scale is easy with this high-contrast, quick-processing film. It gives you sharp, clean results when enlarging microfilm negatives, or reducing large drawings, blueprints, maps. Can be handled with "1A" safelight, and exposed in enlargers, projection printers, process cameras.

Really something every engineer, draftsman, and blueprinter should get full details on now. Call your local Kodagraph dealer for free literature, or write to Eastman Kodak Company, Graphic Reproduction Division, Rochester 4, N.Y.

NEW! Kodagraph

REPRODUCTION FILMS



KODAGRAPH FILMS...

PMI GOES TO A SHOW

Some years ago, our worthy contemporary, *LIFE*, used to have a department called *Life Goes to a Party*. Every week, there would be a new and exciting party for indefatigable *Life-people* to cover. Well, we at PMI are beginning to feel that perhaps a *PMI Goes to a Convention* might be in order. Part of our staff just came back from a high-speed affair in Washington when up comes an affair to Chicago to snatch away from their desk, pastepot and coffee-cup, some more PMI people. The upcoming function is the Fourth Annual Visual Communications Congress at the Sherman Hotel in Chicago.

Sponsored by the Society of Reproduction Engineers and the American Institute for Design and Drafting, the Congress will be held from December 3 to 6. Topics to be covered include What's New in Drafting Equipment, Miniaturization of Engineering Drawings, Electrostatic Printing, Office Services, etc. and etc. Panel discussions will be held every morning to discuss fully the areas listed above.

The people in charge of arrangements have done one thing which will earn them the undying gratitude of at least one weary session-hopper. Major sessions have been scheduled to avoid conflict so that the visitor no longer need make a Hobson's choice between two (or sometimes three) equally important meetings. Specialized sessions will be, according to the convention people, divergent enough to make a choice painless.

The panel programs will be held in the morning and the equipment displays, an equally important part of any convention, will be open in the afternoon. This is another step which should earn thanks, not only from visitors but from the people whose displays are important to the success of any show.

William J. Burdick of the Naval Ordnance Plant, Chicago is Chairman. The committee is composed of: Harry E. Shimp, Lockheed Missile Systems, California; C. H. Henderson, G.M. Truck and Coach Division, Michigan; James Martin, Briggs-Stratton Company, Wisconsin; William Ragan, William Ragan & Associates, Texas; Joe Parks, City of Jackson, Mississippi; Fate Cupps, Amerada Petroleum, Oklahoma and N. N. Freling, Phillips Petroleum, Oklahoma.

According to SRE estimates, over 7,000 people are expected to attend, with over a million dollars worth of equipment being exhibited.

This field has had a spectacular growth since World War II, due partly to the tremendous need of American industry for better-trained people and partly to the unique ability of visual methods to teach more people better in less time. Like its sister field, photography, visual communication has come a long way in discovering new methods to meet new tasks. The people in the field cannot afford to stand still lest they be drowned in a sea of new developments. As a result, shows and conventions in our industry become more than just an interesting break from normal routine; they are almost a necessity for professional survival.

We are looking forward to meeting you in Chicago.

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Allows temp controlled water to circulate under trays, eliminates duck boards.

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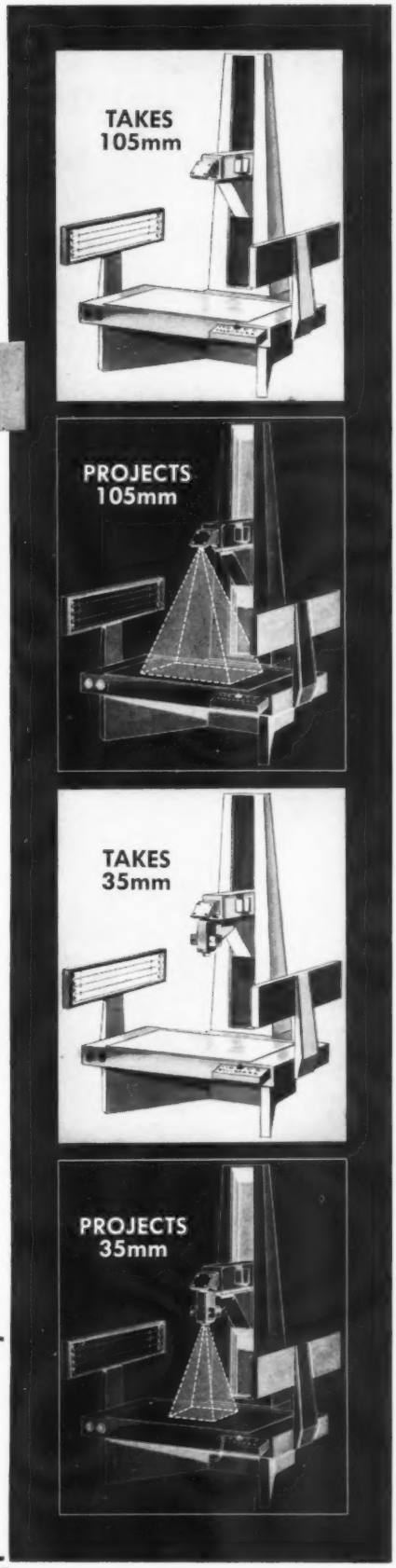

* BALANCED BACK LIGHTING . . . rheostat controlled, uniformly diffused over the entire subject area. With controlled front lighting and a vacuum subject holder, you have the ultimate in micro-photography.

As a camera, the MICRO-MASTER® 105/35mm proves its "class" on the toughest jobs — soiled, low-contrast originals, mottled sepias, doubled-sided tracings. The light is just right, contrast is heightened, the smallest details caught on the negative.

Eleven other exclusive refinements make MICRO-MASTER the most advanced unit for engineering miniaturization available today.

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by K+E

See it now, at your local K&E Dealer's . . . or fill out and mail the coupon below for further information.

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2. LABMASTER lets you view your microfilm days sooner.

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Robert E. Goode

James B. Cooper

MANAGER'S VIEWPOINT

The tech report: a juggling act with celerity, economy, quality

In the course of industrial or governmental work, a report becomes necessary at one stage or another of the operation. This may be a report to the stockholders or management, or it may be a technical report to engineers or a contracting agency.

These reports have one thing in common—the communication of information. However, past this point, reports generally take widely divergent paths. The report to management or stockholders is invariably well composed, profusely illustrated, artistically laid out and beautifully printed. The technical report on the other hand, is often poorly composed, badly illustrated with "grab shots" and badly drawn graphs, and reproduced by any means that will get the information on paper.

The usual excuses for this divergence fall considerably short of the truth. The slick report to management or stockholders is justified on the basis that "The old man likes to put on the dog"—"The front office doesn't care"—"This is deducted from taxes," or other inane and similar drivel. The poor quality of technical reports is excused on the basis that it takes too long to turn out a good looking job and that speed is paramount. Often this is coupled with the idea that the information presented is of paramount importance and that the quality of presentation means nothing to the recipient. Overriding these excuses is the invariable third one—"We have no money in the research budget. This report has to be produced on a shoe string."

Actually, at the reproduction stage it sometimes costs more in time and money to reproduce a badly prepared report than a good one.

The slick report is slick because men experienced in advertising and with a knowledge of basic motivation have a hand in their preparation. They know that the package has a great effect upon the acceptance of the product by the consumer. Chanel No. 5 in a pop bottle, or a fine steak wrapped in old newspaper will not readily be bought, if at all. The products are the same even if not in good packages, but there is an unconscious revulsion against the product *because of the package.*

The same principle holds with the technical report. The most valuable knowledge in the world, poorly presented, will look a little less important in the eyes of the consumer if it is not properly packaged. Inadequate, or insufficient photographs, poor copy preparation and bad printing will always reflect on the author to his detriment. Therefore it is our job to overcome the effect of spurious excuses and present the author to the consumer in a light commensurate with the importance of his information.

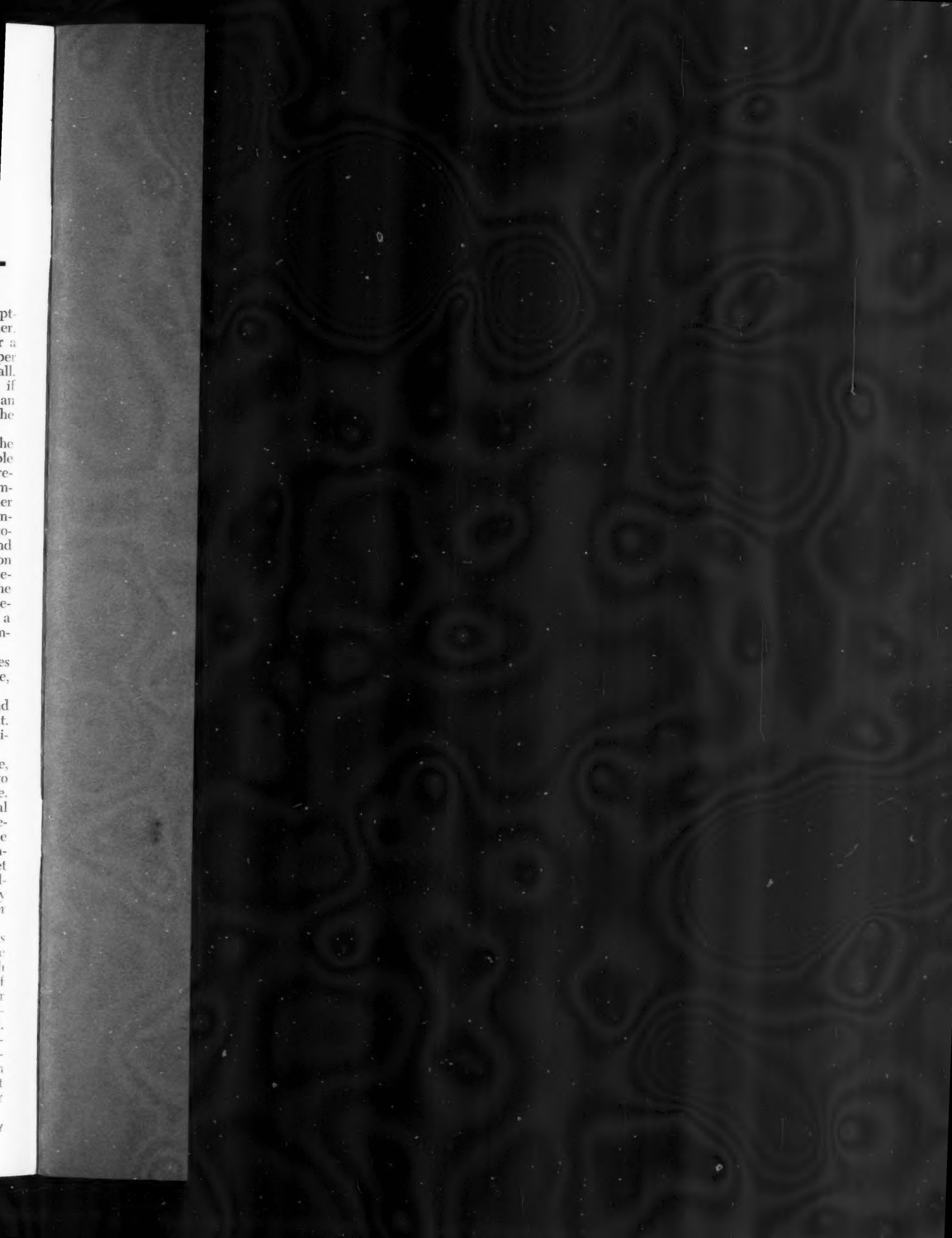
Research contracts sometimes specify in detail the format, style, illustration, etc.

However, agencies differ, and there seems to be no fixed format. In addition there is no direct definition of quality or elegance.

The feel for this intangible, "Quality," is inherent in all of us to a greater extent than we realize. More often than not, when external pressures of time and money are removed, quality improves. Since these pressures cannot be removed in general by an increase in the budget or a lengthening of the time available, the required increase in quality has to come about through higher efficiency and improved methods.

The writers propose to point ways of attaining these goals in future columns. It is our hope that through relating our experience and that of all of you willing to send us your ideas, that the goal of fast, economical, good "packaging" will be gained.

Obviously, poor budgeting of research funds for reports is a problem for management to deal with on two levels. First, a definite amount can be specified in the contract for



reports. Second, if this is not done, the comptroller can set aside a specified amount from contract funds to be used only for reports. Our concern is with speed, economy, and quality. All three are easily achieved with a little planning and foresight. The in-plant reproduction facility seldom gets a crack at the fancy annual report because the facility is thought of only as a cheap rapid reproduction set-up and in some cases that is all it is. However, the facility that has offset printing or duplicating equipment and the means for making or obtaining negatives and metal plates can produce as fine printing as any commercial firm. Two conditions should prevail, however, to achieve fine printing in an industrial plant and they are these: 1.) Enough time should be available or schedules flexible enough to do some experimenting and to take enough time to do a good job. 2.) All personnel working on printing projects should be sharp craftsmen who take pride in their work and who are willing to learn and improve.

The personnel requirement brings up the question of where do you get such people? The best source of craftsman printers of course will be found in the printing trades. A letter pressman can be retrained for offset quicker than a girl can be shown how to run a duplicator. Vocational high schools turn out young men eager to advance in printing. Pick your boy backed up by recommendations of the vocational teacher and train him to do what you want. Occasionally journeyman lithographers turn up looking for steady employment and can be put to work in an industry without complications.

The requirement that all should be interested in learning and improving extends even to the boss. He should make it possible for ideas to flow both ways and inspire his crew to use their imaginations to come up with a better product—a report pleasant to look at and easy to use—suited to the intent of the originator and within the budget.

Although the writers intend to touch on other methods of reproducing reports in small quantities the *professional touch* is only obtained by careful choice of papers, inks, and fine printing. A printed page looks, feels, and is authoritative—a typewritten page is transitory.

The emphasis in this column will be on photo-lithographic reproduction using equipment usually found in a reproduction department. We hope you—and we too—may benefit from the ideas which can be discussed here.—THE END

REPRODUCTION TRENDS

In a typical application of the POST Diazo Materials Selector Chart, a draftsman, supervisor and reproduction specialist solve a special print-making problem in short order.

Solve unusual reproduction problems with new Diazo Selector Chart

Keeping up with rapid developments in graphic reproduction and communication techniques is a difficult job these days, even for the experts.

From the engineer's and draftsman's point of view, it's largely a matter of sorting out the specific information which helps him do a better job.

The new POST Diazo Materials Selector Chart does just that—provides a condensed, tabular reference piece that helps you anticipate the ideal diazotype prints for various needs before they occur. This convenient chart gives brief information on sensitized papers, intermediates and specialties in terse "what, when, why and where" style.

If you're concerned, for instance, with print distribution to different departments, units or groups, then prints on a variety of colored stocks might be the answer.

Increasing print production from diazo equipment with a lower-power light source . . . making legible prints from worn old tracings . . . even making copies from an opaque print . . . all can be handled by use of new POST 206M-14, a fast, extra-sensitive whiteprint paper.

Suppose a design conference calls for a poster, actual size, made from a large engineering drawing, rigid enough for display, tough enough for extreme handling and on-the-spot sketches? POST diazo-sensitized cardstock in 32 or 50 lb. weight can turn the trick on standard reproduction equipment, ammonia process or semi-moist. For many more helpful solutions to similar situations, ask for your personal file-size copy, of the POST Selector Chart, available from your POST dealer or Frederick Post Company, 3660 North Avondale Avenue, Chicago 18, Illinois.

POST

SENSITIZED PAPERS & CLOTHS • TRACING & DRAWING MEDIUMS • DRAWING INSTRUMENTS & SLIDE RULES
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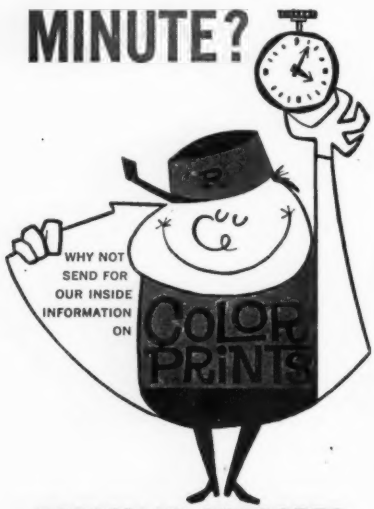

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PMI IN-PLANT REPRODUCTION

Herbert P. Paschel

GRAPHIC ARTS

Maintenance pays off handsomely; here's where to look for trouble

With little or no opportunity to compensate for errors in subsequent steps the graphic arts photographer soon learns the importance of accuracy in exposing line and halftone negatives. Whenever an exposure error does occur, the photographer is often at a loss to pinpoint the exact cause. Any number of variables, singly or in combination, human or physical, may contribute to an exposure error.

Preoccupied as he is with a host of variables, the average photographer rarely thinks of atmospheric dirt as a factor. But the gradual accumulation of dirt and grime in various places can affect exposure in a number of ways. Wherever a dirt film builds up it acts as an absorber of light. And it doesn't take long for a layer of dirt to get thick enough to retard 50 per cent or more of the available light. Let's take a look at a few obvious, and not so obvious places where dirt is troublesome.

Lenses

It would hardly seem necessary to mention the desirability of keeping a lens clean. In the opinion of the writer, lenses are not cleaned with any regularity and, in most cases, not until it is strikingly obvious that something is wrong with lens performance.

The undesirable effects of dirt on a lens are threefold. First, the dirt acts as neutral density filter that cuts down the amount of light reaching the sensitive material. Secondly, the dirt film acts as a diffusing medium that impairs image resolution. Finally, the light scattering effect of the dirt film increases flare with consequent distortion of image contrast. The above remarks likewise apply to reversing prisms, surface mirrors, screen compensators and other optical components of process cameras.

Being exposed to the air, light sources are logical depositories for airborne dirt. With glass enclosed sources such as tungsten bulbs, mercury vapor lamps, fluorescent tubes, cold cathode grids, pulsed xenon arcs, etc., dust and grime accumulate on the outside wall of the glass thus retarding passage of the emitted light. Dust on the reflectors of light sources of whatever type seriously cuts down the light directed to the copy. On a diffuse reflecting surface dust merely absorbs part of the light. But on a highly polished surface dust not only absorbs light but also transforms specular reflection to diffuse reflection—a double loss.

Light sources enclosed in housings —a bulb in an enlarger, for example —may be assumed to be protected from dust. However, these are not hermetically sealed, a passage of air must be provided for dissipating heat. In such cases the accumulation of dust films merely take longer—but they do eventually form. In enlargers, other points to consider are the diffusing panels and condensers.

Exposure integrators

The very instruments that are supposed to insure accurate exposures can be a source of trouble—if neglected. Such devices are meters which measure the quantity of illumination in light-time units and automatically lengthen or shorten the time cycle to compensate for fluctuations in light intensity. In other words, the instrument monitors the radiant energy and terminates the exposure when the predetermined quantity of light has been achieved. To accomplish this the phototube unit must receive an amount of incident light that is equal or proportionate to that received by the copy. Any change in this relationship will change the pre-set calibration of the instrument.

The phototube units of most exposure integrators have a window with an opal glass cover. If either the cover glass, or the tube itself, get a film of dirt the amount of light reaching the tube is decreased. As far as the tube is concerned this decrease in light is interpreted as a change in the incident light. The in-

strument therefore lengthens the time cycle. Obviously, if the incident light is unchanged, dirt on the scanning window (or tube) tends to cause overexposure. The photographer, of course, ultimately corrects this by setting the controls for a lower exposure value, quite unaware what necessitated this change. If and when the tube needs replacing (at which time the cover glass will probably be cleaned) the photographer is confronted with a sudden and inexplicable change in exposure conditions. He will then have to find, by trial and error, a new scale setting that duplicates the previous exposure level.

What to do

A sensible practice is to make an illumination check periodically, say once a month—more often if conditions indicate a high dust content in the air. A foot-candle meter, rather than a conventional exposure meter should be used to measure the light intensity. Measurements will have to be taken close to the light source and many exposure meters will simply swing off scale under such conditions. Foot-candle meters, on the other hand, usually have a range switch by means of which it is possible to adjust meter sensitivity in accordance with light intensity. Furthermore, the scales of fc meters have finer and more accurate divisions. A compact and reasonably priced ($75) meter for this purpose is the Gossen TRI-Lux Foot Candle Meter By means of the three sensitivity ranges and a 20X multiplier this instrument will measure up to 12,000 foot candles.

Aside from its value in keeping light intensity at a constant value, maintenance has other benefits. With light sources operating at maximum efficiency, exposure times will be kept to a minimum. Short exposure times will also mean lower power costs. The time spent in cleaning up will be repaid many times over in increased production at lower cost. Needless to say, cleaning should not be attempted with the equipment connected to the power line.

And don't overlook viewing lights. Visibility increases as the intensity of illumination increases. So does the ability to discriminate fine detail and contrast. It follows, therefore, that a gradual diminishing of light at points where work is inspected will influence the accuracy of visual judgment. While this has no direct bearing on photographic exposure it does influence the photographer's evaluation of the result of an exposure.—THE END

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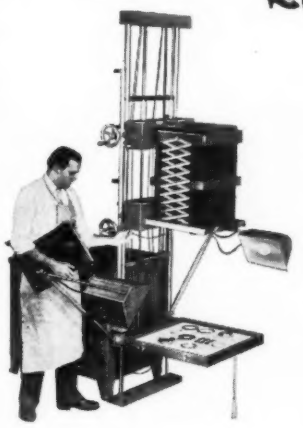

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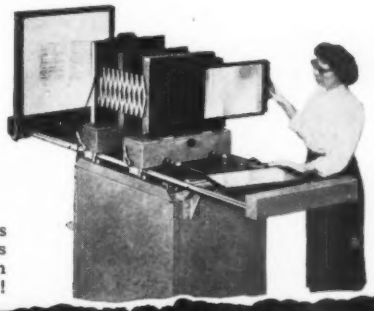

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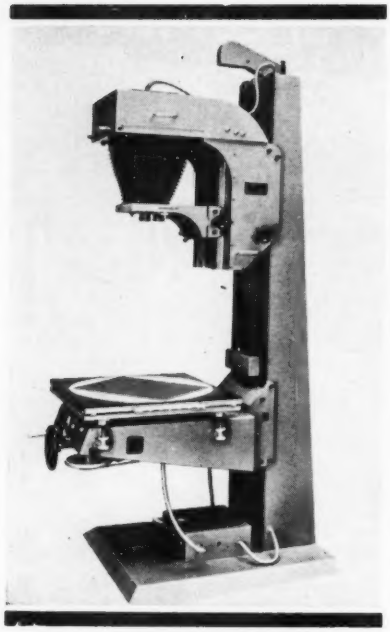

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Arthur D. Even

ENGINEERING DATA PROCESSING

The engineering document, and why it resists mechanization efforts

It is a pleasure to join the PMI staff in this issue as a contributing editor. For one reason, there is the personal gratification which comes from an association with a fine publication, especially one devoted to the dissemination of technical knowledge. Another involves the freedom of topic selection. This means that the column will not be inhibited by a straitjacket of editorial policy. Also, instead of being confined to one small segment of engineering data handling, this column will have the opportunity to discuss the many facets of the engineering data situation. In other words, this column is intended not as a means of rehashing, or selling, or justifying a narrow range of technology. Rather it will try to look at the entire engineering data processing picture. In the process it will explore with you the things that have been done, those that are currently being tried or accepted, plus concepts, ideas, and future plans. Probably one of the most important reasons for accepting this challenging assignment concerns the fact that this publication recognizes the big, broad, international trend toward improved methods for the handling of engineering information. This is important to those who have aided this movement by pioneering in the field. It is through this type of solid support that the interests and efforts of people in the engineering department and at various levels of management can be directed toward continuing improvement. This progress is essential to organizations as well as to the nation's welfare.

From the very beginning we should recognize also that there will be the problem of lack of conclusive proof. For example, a reader of a reputable publication will find that its advertisements generally are factual and representative of the machines and materials in question. On the other hand, the same publication might carry an article about a major engineering data processing improvement program. If the program is long range and of any degree of magnitude, there is a very good chance that the discussion includes many concepts which are theoretically possible or probable but which are not, at the time of reading, tried and true. This comes about due to the long time frame from the beginning of the project to the point where the organization can assess the worth of the improvement (often measured in years). During the interim, the system designer, the company, or some outsider writes about the improvement. Unfortunately, the tone of many of these articles tends to lead the reader to believe that he is confronted with an accomplished fact. However, before we condemn the publicizing of new things in advance of demonstrated success, let us remember that there must be some pioneers. From these trials come advances in technology. So discussions of new things will include a few cautions every now and then.

One, especially if he is himself an engineer, often is reluctant to discuss engineering operational problems with non-engineers. A major reason for this is the sensitiveness which has developed in the average engineer over alleged administrative weaknesses. It is not intended here to perpetuate the myth of general engineering administrative incompetence. Engineering is not selected because the operation relatively is so bad that it just must be improved. It should be noted that in many companies the engineering department is operating a better data processing and record keeping system than are sister departments. Engineering is viewed as a natural starting point for improved data handling of the entire organization. If, for example, effective data processing can begin with the drawing area of the engineering department and flow smoothly into the systems of production and service, we have a base on which to build further improvements

(*continued on page* 17)

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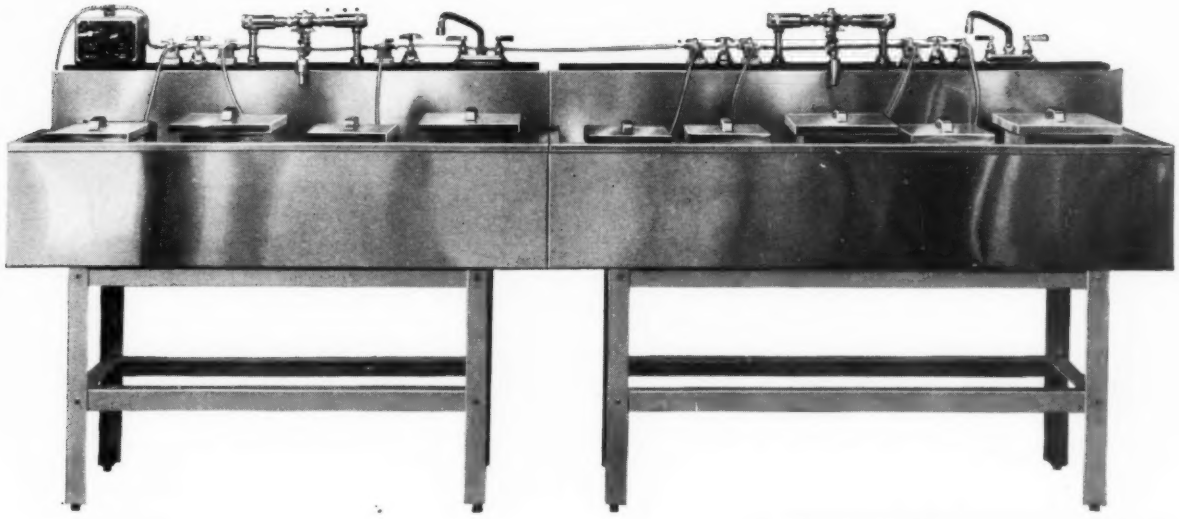

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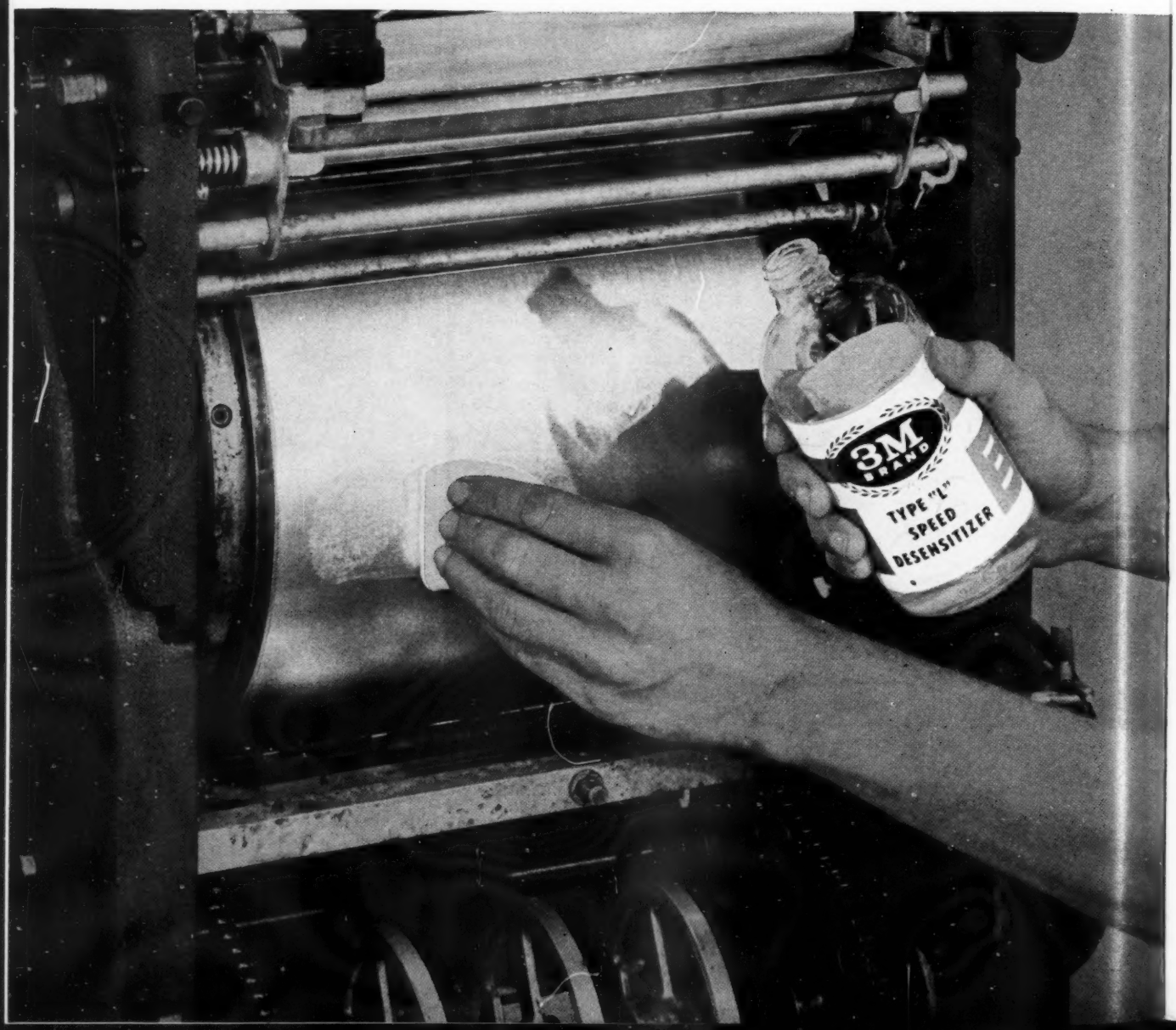

DATA PROCESSING
(*continued from page* 14)

should this be found to be desirable. If the company finds that it absolutely must use punched cards or electronics in its production and inventory control as a matter of competitive survival, engineering operations should also be studied as a part of the data processing system of the organization. So throughout our analyses let us take an objective view of engineering improvement. In this way we should arrive at constructive suggestions which will be of maximum benefit.

Now just why have improvements in the handling of engineering data been slow in arriving or of receiving general acceptance? It is believed that the major reason is the fact that engineering information is somewhat different from that of the other departments. For example, most plans for the speeding up of data generation, distribution, storage, and retrieval in non-engineering departments are aided by the fact that the information to be handled is not pictorial or graphic in nature. In other words, this information can be handled in the alphabetical and numerical symbols of our language. Through the use of coding techniques, the data in some stage of the handling cycle may be in a form not understandable or even visible to the human. However, by processing the storage medium through another machine or so, the information again emerges as something that we can read and understand. When we consider the engineering data package, however, we are confronted with an entirely different situation. Here the engineering drawing long has been recognized as the prime document for the communication of engineering ideas. The drawing is pictorial. It is often large and usually expensive. Until recent years, the thought that the engineering drawing would fit into any sort of mechanization plan was considered rather absurd. The drawing was made using materials which were sufficiently translucent to allow the passage of light through them in a contact printing type of reproduction process. On the other hand, documents which supported the drawing as a part of the complete engineering data package could be typed and reproduced using any number of common office type reproduction techniques. This latter information could also be placed in punched card or punched paper tape form or manipulated in digital computer equipment. However, it was believed that this equipment was too expensive for the handling of just part of the engineering data package. Nor were engineering managers inclined to share this equipment with certain other operations of the company which tended to tie up the equipment periodically and delayed the processing of engineering information in the process. So while accounting, production control, and inventory control, to name a few, adopted mechanical and electronic processing methods, the drawing remained the big stumbling block in the way of engineering improvement, and the engineering departments, for the most part, remained pretty much on a manual handling basis. Then things began to happen which started to move the large engineering departments off of dead center and on the paths of improvement. In our next column we shall discuss some of the things which are being done to place the engineering department right up with the leaders in the improvement efforts of the organization.—THE END

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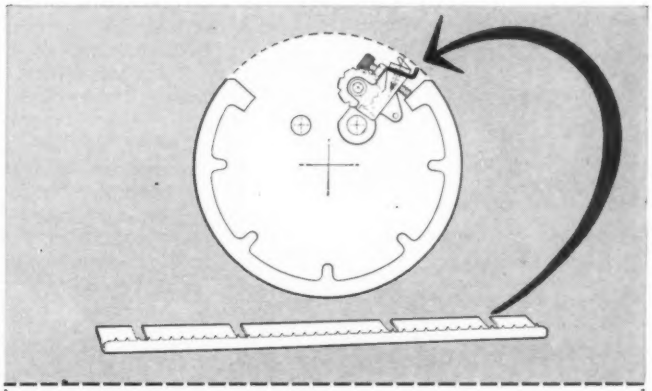

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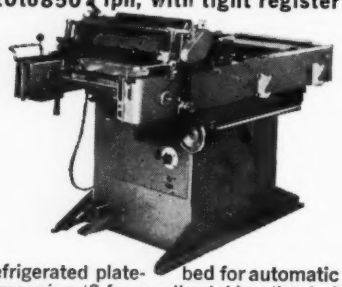

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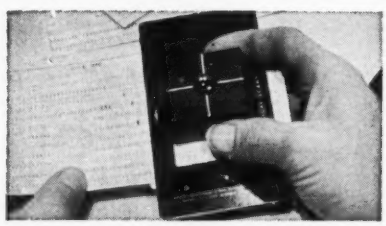

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PMI IN-PLANT REPRODUCTION

Vernon Tate

MICROREPRODUCTION

Quality standard, Part III: the Nelson Contrast-Resolution Index

Last month a discussion was provided in this space of the fact that the National Bureau of Standards appraisal of resolution was based on the reproduction of printed originals. Good evenly-inked letterpress is nearly ideal grist for the microfilm camera. Unfortunately, most originals have had little or nothing to do with the printing press, and are less than ideal subject matter. This complicates the entire discussion. Moreover for our purposes, it would be ideal if all images of fine lines could be completely transparent in the negative and the boundary between transparency and opacity be sharp and distinct. In practice this is not true.

These factors provide some useful hints to the reasons for the difficulty of making a subjective reading of a resolution chart. To complicate matters further, it has been demonstrated that in some instances films of substantially higher resolving power under test produced images of less relative image sharpness than films whose resolving power was in the magnitude of 100 1/mm lower. Microphotographers do not deal solely in reproductions of black-and-white test objects but must accept their originals as they come. Consequently the measurement of line density both in the original and in the reproduction becomes essential.

In an exceedingly important study entitled *Some Basic Factors Affecting Readability and Reproducibility of Microfilm*, R. F. Rodgers and C. E. Nelson of the Bell Telephone Laboratories reported the results of investigations directed specifically to the extension of known standards as applied to the reproduction of engineering drawings. Their findings apply equally well to other fields.

With existing methods of acquiring resolution data and information on background density as a starting point, they attacked the problem of measuring and correlating line densities as factors in the overall problem.

There is no known commercially available economical instrument designed for measuring line density either of the original, or of the microfilm reproduction. Accordingly, a special set of engineering drawings were drawn up. They contain every significant line problem and the lettering was intentionally made random. It has been found that some textual microfilms have been termed "readable" even though portions of words were not legible. Random lettering inhibits prediction much in the same way that an optician's chart discourages guessing. All parts of an engineering drawing microcopy must be equally legible.

Test drawings used

The test drawings were repeated on white and blue cloth, on paper and on photographic cloth. Various pencils and inks were used. Each of the 12 originals was then photographed at reductions of X16, X24 and X30 at density ranges varying from low to high; each series of exposures was made at varying resolution. A Macbeth Quantalog Densitometer was used in interpreting the results. The films were viewed in reading machines and printed at 15X on a XeroX continuous machine. Some thousands of prints were made and critically reviewed by a number of individuals who served as a jury. The highly significant results in part are as follows:

1 Print legibility depends both upon resolution and density contrast between line work and background. **2** No legible print was obtained a) when the film line density exceeded 0.45 b) if the difference between the line and background densities on the film was less than 0.25 c) when film resolution dropped below 42 1/mm.

In the synthesis of the large amount of test data that were as-

sembled, C. E. Nelson observed a relationship that can be expressed as a simple equation. This equation, which can be termed the *Nelson Contrast-Resolution Index* is as follows:

Background Density/Line Density X Resolution=Nelson CR Index

Some of the limitations of the equation are expressed in **2** a-c above. It was further observed that with an Index value of 200 or greater, prints were legible; the converse was also true. Certainly the development of the Index and its application to the reproduction of engineering drawings whose stringent conditioning limitations permit data to be applied equally well to other aspects of the microreproduction field marks a long forward step. Work is continuing and the results may well appear in the Standards of the relatively near future.

Conclusions

1 The accepted methods of measuring resolution, although subjective, can be usefully employed in making determinations on equipment, supplies and completed microfilms. The results may not apply uniformly to all other operations but will apply within a particular laboratory or project. **2** The Nelson Contrast–Resolution Index represents an appreciable advance in applied theory. **3** An instrument is needed to measure line density in originals and microfilm reproductions that is simple, accurate, and, hopefully, economical. **4** Additional work is needed in the field.

Selected references

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—THE END

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SIMPLIFIED OFFSET COLOR

Inexpensive, short run, full color reproduction by offset lithography was the promise of the research laboratory a few years ago. Does it work out in practice? Yes, says Peter Jowise—providing you toe the line, but strictly.

Problem: Make 100 to 2000 color prints a week from each of several originals for inclusion in reports. Solution: In-plant three-color offset lithography via the Simplified Short-run Three-color Process.

Traditionally, multi-color lithography has been expensive. Consequently it has found little application in small circulation scientific and technical reports. Hoping to achieve more widespread use of color in this kind of publication, the Eastman Kodak Research Laboratories developed a system for producing inexpensive color in short runs. This development began about ten years ago. It resulted in a system they called the Simplified Short-run Three-color Process.

The expense of multi-color lithography and printing is due to three main problems in the process. These were, and are, the variety of originals and reproduction sizes, registration, and color correction.

Based on the primary expected use for this type of printing, in the field of technical reports, it was decided that only one original size and one reproduction size would be used. This decision allowed considerable, immediate savings. It made unnecessary the purchase of versatile equipment which is expensive. And it made unnecessary the variations in exposure and in camera positioning that are required in a system for more general use. This reduced the time required to produce a set of separations.

Many of the people who generate the illustrative material for technical reports are familiar with photography in color in the 35mm size. They frequently use this medium in their scientific work. For this reason the standard 35mm color transparency was chosen as the original copy on which to base the simplified system of three-color lithography for short runs.

The Kodak Research Laboratories also standardized on the size of reproduction by choosing a format approximately postcard size, about 3½ x 5 in. This size allows convenient reproduction of from one to four pictures on an 8½ x 11-in. report page.

These choices overcame one of the three main obstacles to inexpensive color. By choosing a single original size, which was compatible with the final use of the prints to illustrate reports, economies were effected without aborting the usefulness of the system.

The success of the pin register technique devised for the Dve Transfer Process encouraged the extended use of it in the Short-run Process. There are, in fact, three pin registration systems used in this process at different stages. First, there is the registration of the transparency to its holder and of the mask to the transparency. Second, there is the registration of the images on the three-color separation negatives to each other. Third, there is the registration of the lay-down sheet to the printing plate and the consequent registration of the printing plate to the press.

The inter-relationships of these three systems will be described later in this article.

The final obstacle to inexpensive color lithography was perhaps the most difficult to overcome. The choice of original and reproduction sizes, and the registration of images are purely mechanical techniques. Compared to the correction of color in lithography they are child's play.

Because the need for color correction in printing stems from inadequacies in the inks normally used, simplification was effected in this process by taking a new and fundamental approach. This was simply to specify a "best possible" set of inks to begin with, within the limitations imposed by available ink technology. With this ink set no further color (hue) correction is necessary. Then a masking method was designed to reduce contrast and simultaneously to adjust relative color brightness for optimum saturation.

So much for the background of the Simplified Short-run Three-color Process. Now how does it work? It works exactly like black-and-white halftone photography, done three times. One negative is made by the light of each of the separation colors. But the basic technique of making the halftone negative is the same whether for black-and-white or color. The negatives for color have only one added requirement. They must be balanced to each other. If this balance is not achieved, the final repro-

duction will not exhibit the correct colors throughout the full tonal scale, from shadow to highlight.

There are seven steps in the making of a three-color reproduction from a 35mm color positive original. Step one is to read the highlight and shadow densities of the transparency. Just as in black-and-white halftone photography, these should be areas in which detail is to be retained in the reproduction. The difference between these two densities is called the density range of the original. The amount of flash exposure that will be necessary to strengthen the shadow dots is prescribed by this density range, in the usual manner of halftone making.

Step two is to expose and process the mask. Registration holes punched in the Kodak Pan Masking film (or equivalent) hold the film on registration pins during the exposure. The exposing light is normal tungsten light modified by a Wratten No. 85B filter. Experience has shown that the best results are obtained from a mask of about 40 per cent, covering the full range of the densities of the transparency. A 40 per cent mask has a gamma of 0.4.

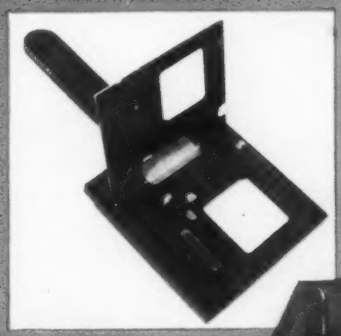
The processing of this mask is a critical part of the process and it is rather closely controlled. The contrast and the density must be held to close tolerances. These are about ± 1 per cent for contrast and ± 0.05 for overall density. Experience has proved that these tolerances have never been a problem after the system has been put into operation and is working routinely.

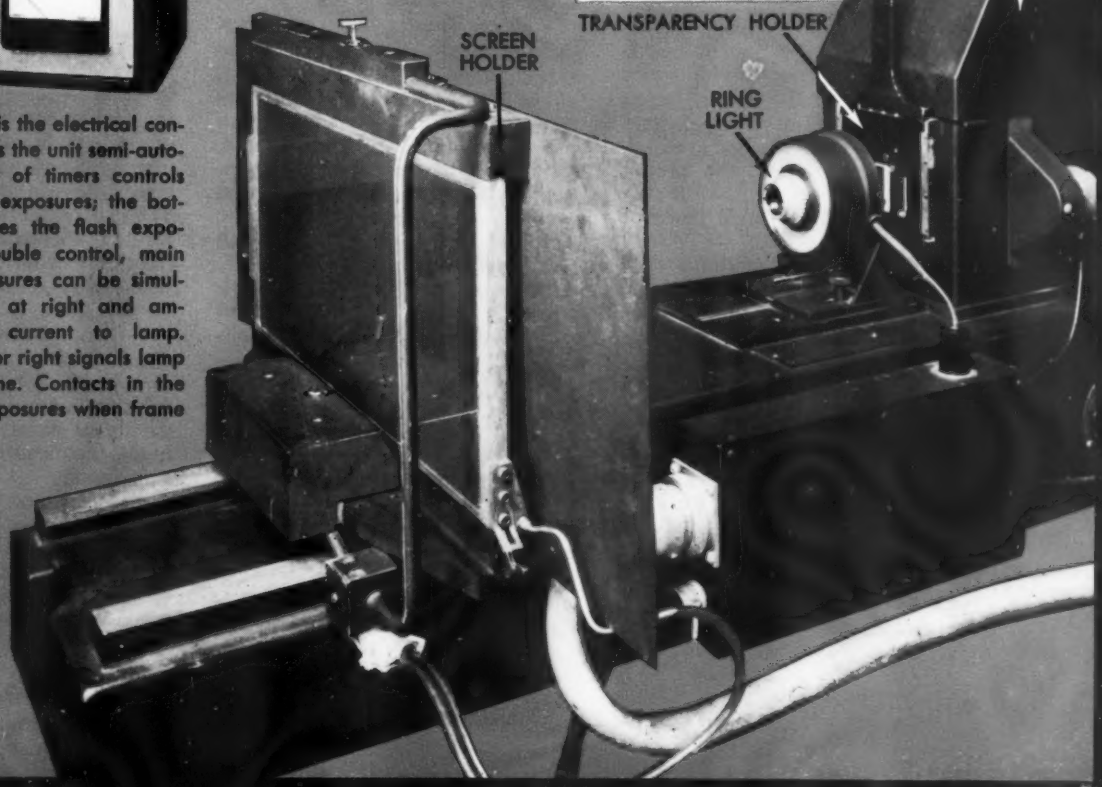
For ease of registering, and for increasing local contrast, this mask is of the unsharp type. The cardboard mount of the transparency holds the masking film some distance from the emulsion of the transparency. This allows diffusion to occur. To increase this effect, a ring-shaped aperture is used between the exposing light and the film. This produces a controlled degree of diffusion and consequent unsharpness in the mask image. Other techniques can be used (as described in graphic arts hand-

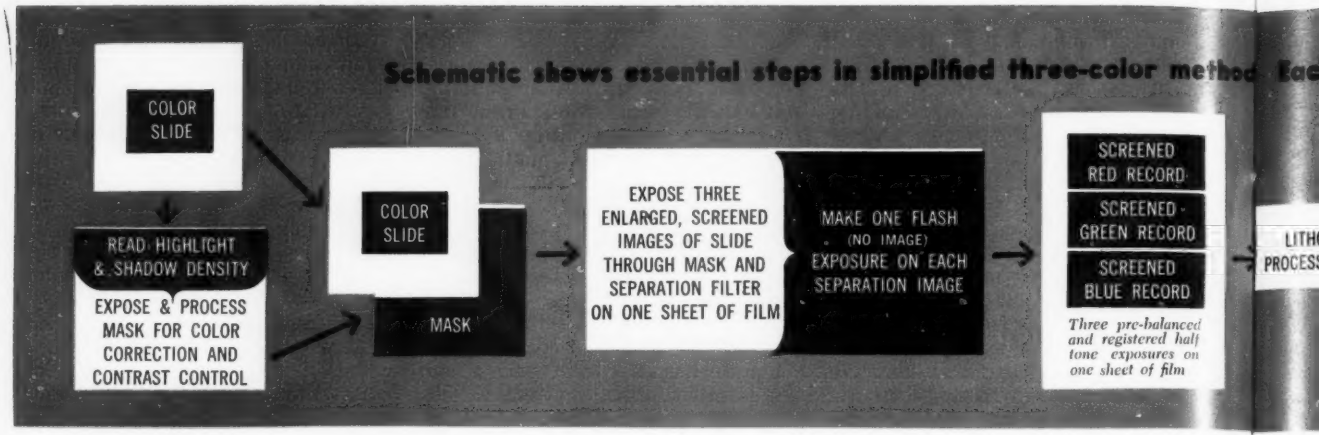
CAMERA STANDARDIZES, AND THEREBY SIMPLIFIES, SEPARATION WORK

The box above is the electrical control which makes the unit semi-automatic. Top row of timers controls the three main exposures; the bottom row handles the flash exposures. With double control, main and flash exposures can be simultaneous. Knob at right and ammeter control current to lamp. Counter at upper right signals lamp replacement time. Contacts in the camera start exposures when frame is positioned.

Below is a semi-automatic three-color separation camera; the slide carrier is at right. Two little springs in the carrier register slide in the opening and the pins register the film mask. The slot houses a step tablet. In the camera, a rotary solenoid shutter effects exposure (see bulge at side of lamp house). The mechanism below houses the film, three balanced contact screens.






Schematic shows essential steps in simplified three-color method
COLOR SLIDE
READ HIGHLIGHT & SHADOW DENSITY
EXPOSE & PROCESS MASK FOR COLOR CORRECTION AND CONTRAST CONTROL
COLOR SLIDE
MASK
EXPOSE THREE ENLARGED, SCREENED IMAGES OF SLIDE THROUGH MASK AND SEPARATION FILTER ON ONE SHEET OF FILM
MAKE ONE FLASH (NO IMAGE) EXPOSURE ON EACH SEPARATION IMAGE
SCREENED RED RECORD
SCREENED GREEN RECORD
SCREENED BLUE RECORD
Three pre-balanced and registered half tone exposures on one sheet of film
LITHO PROCESS

books) but this simple one works well in an economical, standardized process such as this.

After drying, the mask is returned to the transparency holder. The same pair of pins which held the film during the mask exposure now register the mask image to the transparency image automatically.

Step three in the process is to expose the separation negatives. For simplicity in production the halftone screens can be purchased as a balanced set from the Eastman Kodak Company. The inherent contrast of the screens in the set has been adjusted to allow all three separations exposures to be made on one large piece of film. This is processed as a single unit. Normally this would result in a blue separation negative of lower contrast than the red and green separations. In continuous-tone work this can not be avoided. In halftone, however, the proper choice of screens does make it possible to use only a single piece of film.

The benefits of handling only one film are three. One, there will be no individual size changes to cause misregistration. Two, processing is necessarily identical for all three negatives, hence contrast and density are simultaneously controlled in all. Three, the negatives can not be interchanged and used to print the wrong color.

The mounted screens are angled as necessary to prevent the appearance of a moire pattern in the final reproduction. Such screen sets can be purchased from the Eastman Kodak Co., mounted on a section of optically flat glass, which is held in a metal frame (supplied by the customer to fit his own camera). A vacuum channel in the frame makes it possible to hold a sheet of Pan Kodalith (or equivalent) film in intimate contact with all three screens.

The frame is positioned so that one of the screens is in the area that will receive the light projected by the lens from the transparency. If this is the screen for the red light exposure, it is made with a Wratten No. 25 color separation filter in place. A white-light flash exposure, to compensate for the "excess density range" (this is the same terminology used in black-and-white halftone work) is given also. These two exposures can be made simultaneously or sequentially.

The frame is then moved to the green exposure position. With a No. 61 filter in the light path the exposures are made for the green color separation. This is followed on the third section of film by the blue filter separation made through a No. 47B filter.

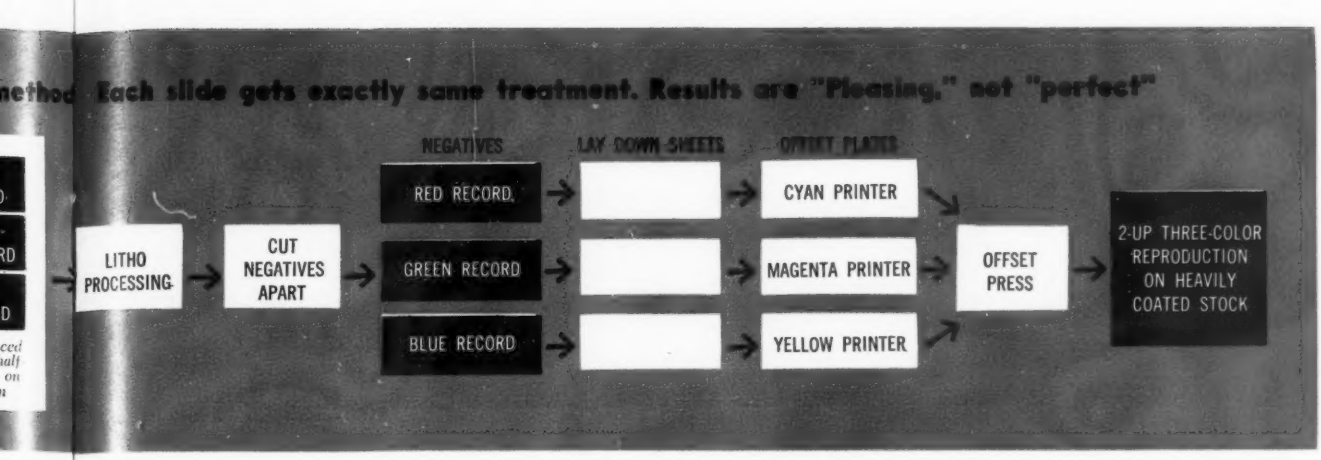
The exposure times are pre-balanced to compensate for the filter factors and for the desired halftone dot structure. Typical exposures for an efficient optical system are red:green:blue: about 10:10:40 sec. Flash exposure varies depending on the density range of the original.

While these exposures are being made, the film is open to the dark room. Naturally no general illumination, even safelight, is possible while working with panchromatic film. The timers that control the six exposures, three image-forming and three flash, must be set in the dark. However, for the routine production of this kind of negative this is impractical. The solution to this problem is to use six timers. Each one can be preset to its proper exposure time and can be actuated in the dark at the appropriate moment.

Step four in the process is the developing of the set of halftone negatives. It is in this step that standardization and consistency pay their biggest dividends. Rigid temperature control at 68°F is an absolute necessity for reproducibility. A smooth and constant agitation technique is no less important and must be adhered to religiously. A method simulating the motions of interleaving type of action has proved to be most consistent and streak-free. New developer is used for each piece of film and is then discarded. Sounds expensive but money is saved in the long run in consistency in production.

The good halftone man can process two identically exposed negatives and come up with two identical sets. The outstanding man can do this even though he processes the two negative sets six months apart. Experience has shown that it can be done. For economical color it has got to be done. After drying at room temperature overnight the negatives are ready for step five.

At this point the process passes from the strictly photo part of photomechanical reproduction to the mechanical part. The negatives are marked "yellow printer," "magenta printer" and "cyan printer"



and are coded by number, or other identification. They are then cut apart.

The second of the three pin registration systems is now used in placing the negatives on the lay-down sheet. This sheet is opaque and is large enough to mask off the total printing plate area. It has a clear area frame through which the plate will be exposed to the negative. It has also two control devices incorporated in it. These are a step tablet and a "tint strip" negative. The step tablet is a control for plate exposure. The tint strip has a control function in printing.

Each separation negative contains two holes alongside the image area. These were made during the negative exposure by a pair of solenoid-driven punches. Or they could be pre-punched. In the latter case the film would have been registered on a pair of pins while the exposure was being made. Whatever the specific method, the end result is that each negative contains two registration holes that bear exactly the same positional relationship to the image as do the pairs of holes in the other negatives.

The lay-down sheet has, firmly attached to it, a pair of registration pins. These bear the same relationship to the image area of the lay-down sheet as do the holes in the negatives to their image areas. The yellow printer negative is pressed onto the pins. It is taped down, at the pins, and nowhere else.

At this point enters registration system number three. Utilizing the Kodak Matrix Film Punch, the lay-down sheet has been punched along its top edge. A photo-sensitive plate, such as the 3M aluminum plate, has also been punched along its top edge. A brass strip (perhaps 0.010 in. thick) with two positioned register pins (ground flat so that they are only about 0.030 in. thicker than the strip) is used to register the lay-down sheet to the plate.

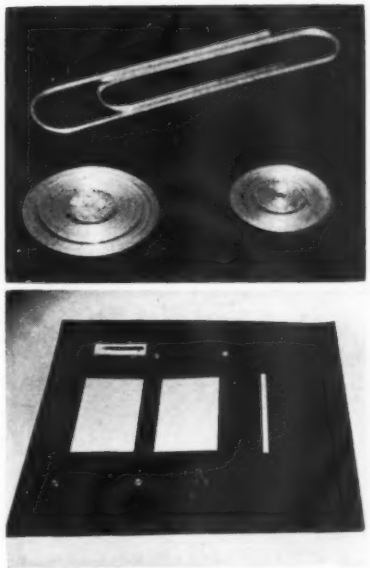
This brings us to step six in the process, the making of the plate. The step tablet on the lay-down sheet allows a series of graded exposures to be made on the plate. When the plate is developed, it is necessary that the step corresponding to a density of 0.9 in the tablet develops up strongly, so that it can not be rubbed away. If the plate shows under- or overexposure of more than one step on the scale, +0.15 density units, it should be discarded. A light integrator-controller is a very useful device for insuring consistent plate exposure.

The step tablet is so placed on the plate that it will print either in the binding margin or on an edge of the paper that will be trimmed.

The magenta printer and cyan printer plates are made in precisely the same fashion as the yellow printer plate. When each negative has been mounted on the registration pins on the lay-down sheet, the properly angled tint strip negative is positioned in its area on the sheet also.

Step seven in the process is the actual printing. A high-gloss coated paper is used as printing stock.

(*continued on page* 43)



Registration problems are reduced with a pin and button registration system. The buttons are shown in the top picture with a paper clip for size comparison. The one at the right has been pushed through a lay down sheet (background). *Below*, the entire lay down sheet is shown. It has two pairs of registration buttons for two, punched halftone separation negatives. The two pins at the left edge register the sheet with a pre-punched offset plate. The horizontal strip at the top of the picture is a step tablet for plate exposure control. The vertical strip at the right will hold a tint strip negative for color balance control. The lay down sheet is stable base film and may be reused many times. Plate exposure is emulsion to emulsion.

MICROFILM IN SUBURBIA

Any county government spawns tons of records. Nassau County, N.Y., is no exception. But its central micro service cuts things down to size

In these days of growthmanship, New York's Nassau County can outploy just about any place in the United States. This Long Island suburban complex of towns, incorporated villages, unincorporated villages, school districts, concrete clover leaves, golf courses and developments—all planted firmly on former potato ranches—spurted from a population of 400,000 in 1940 to a million and a quarter in 1960. In the past ten years, it nearly doubled itself.

Nassau County's microfilm service, which happens to be one of the oldest in county government, cannot cure the suburb's growing pains, but it has gone a long way toward soothing them.

Nearing completion now, for example, is the microfilming of county tax rolls for the past 60 years. The massive ledgers in which the tax rolls are kept will be reduced 15 diameters to 35mm microfilm, and then sold for scrap paper. The county will thus be relieved of some 600 tons of bookkeeping. This will clear storage space in excess of the space used by the photo copy service department of which microfilm is a part.

The legal name of the group is the Photostat Department. It goes back to 1927; William F. Ward took it over in 1939 and introduced microfilm that year in answer to the County Clerk's request for security copies of essential records. Ward and an assistant made 150,000 copies for this purpose with a Ludwig-Ott 35mm camera and double perforated safety positive film. The camera served until 1945, when Ward was authorized to buy more modern equipment and to organize a microfilm staff.

In '56 Ward pushed for processing equipment. He got it by convincing county officials that, although in-plant processing would increase costs slightly, it would cut five days to three weeks from delivery schedules. Viewed in terms of returning a home owner's deed in days instead of a month, county officials assented. With the current load of 3½ million exposures annually, Ward believes, the department is at the break-even point where in-plant processing is as inexpensive as outside processing, not counting equipment amortization. The county has the advantages of speed, security, technical control, and a buttress against future cost increases.

Microfilm's service to the county has accelerated even faster than Nassau's population explosion. Now all 45 units of county government have access to Ward's unit, and microfilm volume has expanded 23-fold. The fact that this is a centralized, county-wide service makes his department all but unique, Ward believes, and lowers the cost of microfilming considerably under de-centralized operations in other communities.

For the most part microfilm plays its traditional roles in Nassau County government: as a safeguard against the destruction of essential documents in case of catastrophe, and as a space-saver.

More recent applications of microfilm—such as quick-access active files, low-cost intermediates for short run copies etc.—are not in evidence. Part of the reason for this is that in many cases state and county laws require the keeping of original documents in perpetuity or for a duration set by a statute of limitations. Thus while microfilm technology in Ward's department has advanced to the point where it could offer county government even more advantages than it presently does, they will not be feasible until many of the laws affecting county government throughout New York State are changed. This is obviously a long-term proposition.

As it stands now, the rule is *not* to microfilm any record which can be destroyed after a reasonable length of time, but instead to file original copies until the law permits their destruction. The cut off point is 15 years.

This still leaves plenty of room for microfilm to improve the situation. A good example is a big job done annually for the Board of Assessors. The assessors keep detailed maps of all taxable property in the county. As plots are divided and subdivided, the changes are entered on the existing maps, or it is sliced up and property lines drawn on new maps of larger scale. The catch is that, under the law, no alteration can be entered until a record is made of the previous map. At one time this record was made via a halfsize Photostat copy. Being an official document, the photocopy was made on linen paper stock and processed for archival storage. The bill for the paper alone was $500 to $600 every year. Now the whole works is quickly recorded on 16 rolls of 35mm microfilm.

Some of the copy is pretty rough, e.g. diazo copies from tracing cloth, but it has been possible to make a

readable micro image of every map. Tough cases usually submit to slight underexposure.

Other important jobs include the recording of all records pertaining to wills for the Surrogate Court (these were once transcribed by typewriters with special platens in large sewn books), payrolls after two years, purchase orders after four years and autopsy records after five years.

Only one of the jobs involves unitized microfilm. This got under way when Meadowbrook (county) Hospital personnel asked Ward for help in consolidating patient records, which occupied seven storerooms. Roll microfilm was rejected because they wanted all the records for a single patient together, and a baby born at the hospital might conceivably return to Meadowbrook at any time through the century that follows the birth.

The system finally settled upon is this. Records are held in paper form for seven years, at which time some may be destroyed under the statute of limitations. The remainder are photographed on 16-mm microfilm with a planetary camera at 20X reduction (the originals are 8½ x 11). Before photographing a patient's folder a medical librarian makes out a title page which lists the case number and the number of documents included in large figures.

When a 100-ft. roll is filled, it is sent to Ward for processing, inspection and filing into 8 x 5-in. acetate jackets.

The records are confidential, and cannot be sold for scrap. Instead, they are destroyed after mircofilming. The librarian witnessing the destruction certifies the means of destruction.

The jacket may hold records for but one patient. Its capacity is 96 frames, but it will hold a single page plus the title page just as securely. The microfilm department does its part of the job in an eight-hour day. With transportation included, the cycle is three working days.

Because the jackets are transparent, the film is never removed from them, but additions can be (and are) made whenever the patient returns to the hospital.

The medical librarians at the hospital use a 3M reader-printer for viewing and duplicating the records.

(*continued on page* 55)

NASSAU'S BATTLE WITH BULK

Biggest target for microfilm is 600 tons of tax rolls in ledgers such as these examined by Robert Redfield, W. F. Ward and George Darakjy.

Planetary camera, operated by Arthur Thomas (rear), flow unit run by Harry Bauer and four other cameras turn out 3½ million exposures annually.

Stainless steel staples join film to leader before processing. Actually this is done in the dark. Sole outside service is microfilm duplicates.

In-plant processing is not an economy measure; its justification is greatly speeded service to citizens. Herbert Seaman threads leader in 16mm unit.

Density check, by Herbert Seaman, is part of quality check that includes a monthly analysis of film samples for residual sodium thiosulfate.

Proofreading for loss of detail, skips, is important part of work. R. F. Jones here checks a 16mm frame inserted along with 92 others in jacket.

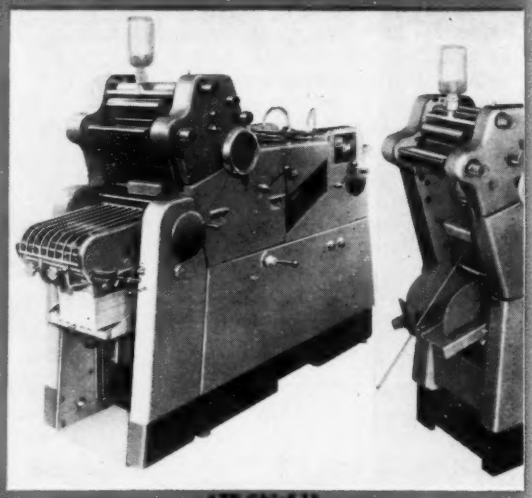
10X15 OFFSET PRESSES

Just as the wooden screw and lever press of Johann Gensfleisch Gutenberg is the symbol of the printing industry—the small lithographic press is the symbol of printing in industry. As printing goes, photolithography is a recent innovation. But it does not lack for adherents. At least six firms in the United States alone supply offset presses in a single category represented in the following pages: presses which accept 10 x 15 plates. One exception was made, a press which takes a 10 x 16 plate, but which we believed to be representational of the group. Among the group are a number of units which the manufacturers would prefer to be known as duplicators, in order not to frighten away buyers who want a machine for limited purposes only. But make no mistake about it, an expert hand can make these presses put out professional work in every sense of the word. The information provided is supplied by the manufacturers. PMI offers it without comment. Other data important to choosing a press for any specific job—such as durability, reliability, service, precision, maintenance costs, productivity and personal preferences—must be left to the investigative powers of the reader

AMERICAN TYPE FOUNDERS

500 Elmora Ave., Elizabeth, N. J.

The ATF Chief 15 is available in two models, tray delivery and chain delivery. The tray delivery model is recommended where most jobs are comparatively short runs on medium-weight uncoated stock. Standard equipment on both models includes: automatic suction-type feeder with two suction heads; center blower and two side blowers; single pull-out roll with double sheet detector; double sheet deflector and tray; two side guides; one set pin-bar plate clamps; re-set counter; chrome plated plate and impression cylinders; nickel-plated cylinder; variable position jogger; light fixture above delivery; one inking unit complete with fountain; ten inking rollers including large auxiliary vibrator; one set covered dampening rollers with metal oscillating vibrator; two motors for 110/115V 60-cycle AC.



ATF Chief 15

Max. printing area: 9¾ x 13¾ in. Smallest and largest sheet: 3 x 5, 11 x 15 in. Gripper margin adjustment: 3/16 to 5/16 in. Speed range: 3400-7200 IPH. Feeder capacity: 21⅝ in. Delivery capacity: (chain) 20⅝, (tray) 2⅝ in. Unit is 50 in. high and requires 61 x 28 in. floor space. Tray delivery model weighs 740 lbs.; chain delivery, 840 lbs.

Available accessories include: ATF Program-Matic unit which automatically shuts off unit at pre-determined number of impressions; dual feed tabulating card attachment for chute delivery; automatic blanket wash-up unit; Scotty Flo-Mix unit to prevent offsetting; ink roller wash-up device; plate priming device; work organizer; hand feed table and static eliminator.

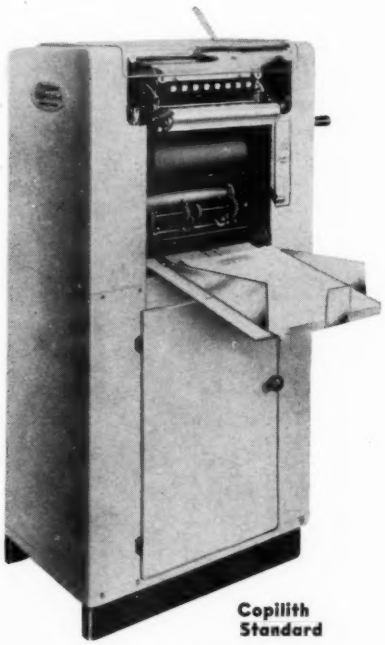
COPEASE CORP.

425 Park Ave., New York 22, N. Y.

The Copilith Standard Offset Press has a top speed of 7000 impressions an hour. It is equipped with suction feed, tumbler grippers, positive ejection and puller side guides for positioning and register. Gripper bite adjustment may be made on either side of the gripper edge for squaring and positioning image on the paper. The paper feeder accepts one load of paper while another load is being fed.

Max. printing area: 9½ x 13 in. Smallest and largest sheet: 4 x 6, 12 x 15 in. Plate clamps are pin-bar type. Dampening is by Copifount —Copease's integrated system. Inking is by two form rollers, two oscillating rollers and swing-up ink assembly. The press requires 33 x 39 in. of floor space and weighs 900 lbs. Paper weights from 11-lb. bond to 4-ply card are accepted. Price is $3750 f.o.b. New York.

A smaller unit called the Copilith Junior which accepts 8¾ x 14½ in. plates is also available. It has a speed range of 4000 IPH. Weight is 200 lbs. Largest sheet and smallest sheet: 9 x 14, 4 x 6 in. Maximum image area: 8¾ x 14½ in. Price: $1695.

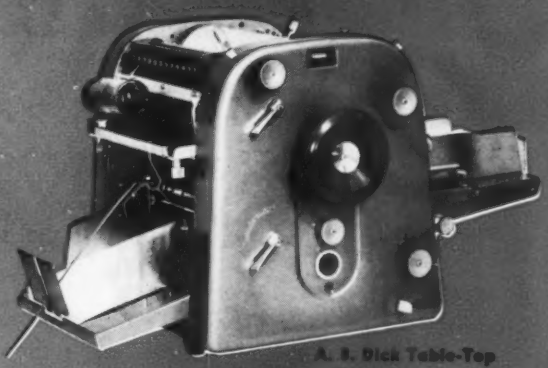


Copilith Standard

A. B. DICK CO.

5700 W. Touhy Ave., Chicago 48, Ill.

This company makes the Model 320 Table-Top Offset Duplicator which falls into our category. Standard features are: Aquamatic control system which meters an exact amount of fountain solution to maintain the water and ink balance; self-adjusting cylinders which automatically compensate for changes in master or impression paper thickness. Master and impression cylinders automatically separate from blanket cylinder when paper ceases to feed; master clamp accommodates both pin-bar and straight edge masters. Auxiliary clamp attaches for serrated and slotted masters; automatic twin feed rollers for paper feed; 6-in. vertical adjustment, angular adjustment and



A. B. Dick Table-Top

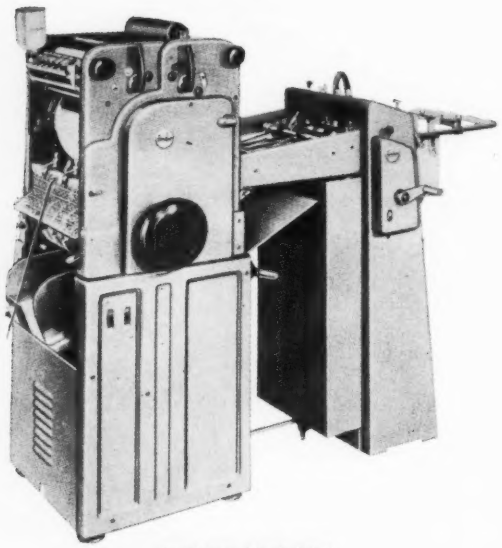
micrometer lateral adjustment devices for copy positioning. Ink and water roller system has six rollers, including the large oscillating roller, two ductor rollers, one ball bearing form roller, two fountain rollers. Table-Top model feed table accepts 500 sheet 20-lb. paper. Table automatically elevates to maintain proper feeding level. Maximum image area: 9⅜ x 13 in. Paper sizes: 3 x 5 to 11 x 14 in. Speed range: 110 impressions per minute, 85 to 130 IPM by service adjustment. Weight: 213 lbs. Dimensions: 35⅜ x 24-1/16 x 20⅜ in.

Accessories available include: Flexible work light; master etching attachment which etches master on the cylinder while machine is running; blanket cleaning attachment which removes ink from blanket while machine is running; work organizer, provides shelf space for master, blanket wash dispenser, supplies, etc.

Continued on next page

DAVIDSON CORP.

29 Ryerson Street, Brooklyn 5, N. Y.



Davidson Model 241

Although the smallest Davidson press accepts a plate up to 10 x 16 in., no listing of this sort would be complete without at least mentioning one of the Davidson line. The Model 241 (*illustrated above*) is the basic Dual-Lith press. Unlike most conventional three-cylinder offset presses, the Davidson unit employs a two-cylinder principle. In this design, the upper cylinder carries the plate and impression segments, the bottom cylinder holds the blanket. Removable segments permit changing from one-sided offset to two-sided lithography, or letterpress, or to any of five other reproduction processes. Standard features include: gripper bar chain delivery; self-adjusting steel feed rolls which adjust for different stock thicknesses; diagonal feed conveyor board. The 241 accepts 3 x 5 to 10 x 14 in. sheets and has a maximum image area of 9¾ x 13 in. Stock weights: 13-lb. bond to 3-ply cardboard. Operating speed up to 6000 IPH. Suction pile feeder holds 5000 sheets of 20-lb. stock. The machine is 55¾ in. high and requires 28¼ x 61 in. of floor space. Shipping weight: 925 lbs.

ADDRESSOGRAPH-MULTIGRAPH CORP.

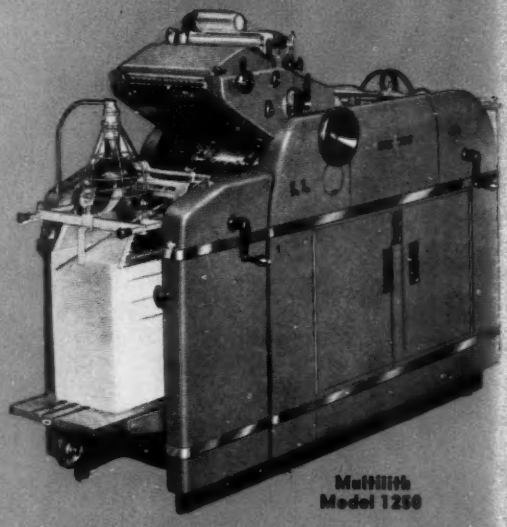
1200 Babbitt Rd., Cleveland 17, Ohio

The best known 10 x 15 Multilith press is the Model 1250 which has a speed range of from 4000 to 7500 IPH. Smallest and largest sheet sizes are 3 x 5, 11 x 17 in. Maximum printing area: 9¾ x 13 in. standard (larger cylinder is available). Gripper margin adjustment 5/16 in. min. to 1¼ in. max. The press has a feeder capacity of 5000 sheets. Delivery capacity: 5000 sheets of 20-lb. stock in the pile delivery model. The unit occupies 27¾ x 72 in. of floor space. Weight: 764 lbs., pile delivery model.

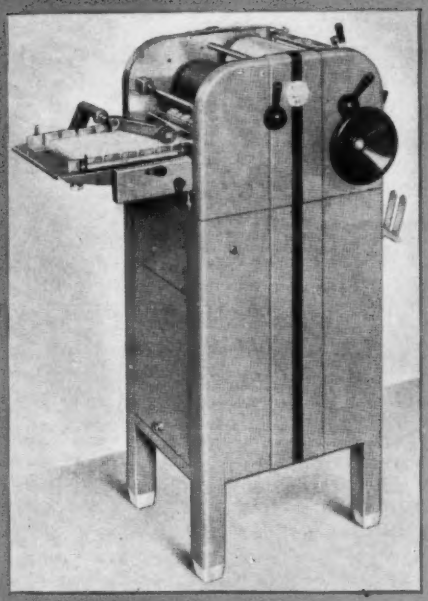
Standard features are: two AC 60-cycle, capacitor-type electric motors; automatic four-roller moistening mechanism; three 6-in. diameter cylinders in duplicating unit; adjustable feed roller mechanism equipped with four stop fingers; master cylinder is adjustable for lateral and vertical positioning of image on paper. Inking mechanism is automatic ten-roller style with cover.

A variety of attachments are available including signature attachment, numbering unit, perforating, scoring and slitting attachments. Receding stacker and infra-red, dryer, alternate sheet feed.

The Model 80 Multilith has a maximum image area of 9¾ x 13 in. Maximum and minimum sheet size: 9¾ x 14 in., 3 x 3½ hand-fed, 3 x 5 machine-fed. A stock range of 16 to 110 lbs. is accepted. Feeder capacity is 100 sheets, delivery capacity, 500 sheets. Speed range is 75 IPM, 48, 64, 78 IPM available. 20 x 24 in. floor space required. Weight: 184 lbs.



Multilith Model 1250



Multilith Model 80

Model 750 Multilith operates at 5200 IPH. Maximum and minimum sheet size: 9⅝ x 14, 3 x 5 in. Maximum image area is 9⅝ x 13 in. This unit accepts stock from 16 to 110 lbs. Feeder capacity is 1000 sheets. Delivery capacity is 500 sheets. Press occupies 22¾ x 53 in. of floor space. Weight: 318 lbs.

Model 1260 Hand-Fed unit operates at speeds from 3000 to 6000 IPH. Maximum and minimum sheet sizes: 11 x 17, 2¼ x 2¾ in. Maximum image area is 9⅝ x 13 in. standard, 10⅝ x 16⅝ in. with special cylinder. Stocks from 13 to 140 lbs. are accommodated. Delivery capacity is 500 sheets. 23 x 37 in. floor space required. Weight: 395 lbs.

Model 1250 AF is basically the 1250 model with automated features which include: Console control panel; automatic feed start control; automatic reset stop counter; automatic cylinder stop control, single lever ink control; and feed shut-off mechanism. Optional automatic features are: Automatic blanket cleaner with machine stop control, variable sheet quality control, paper feed interrupter, automatic platex applicator with machine start control.

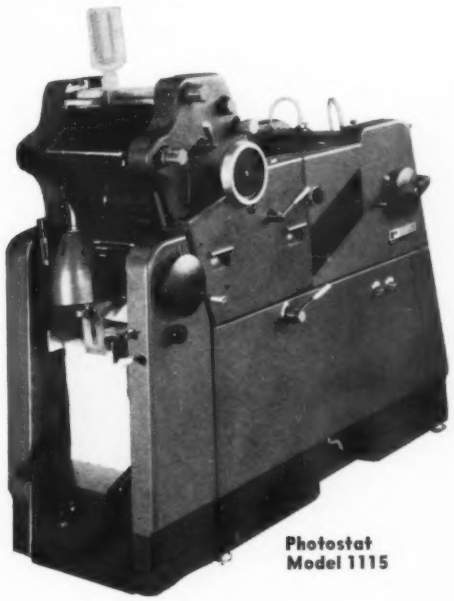
PHOTOSTAT CORP.

1001 Jefferson Rd., Rochester, N. Y.

The Photostat offset duplicator, Model 1115 is available with a variety of receiving systems: jogger-receiver tray (standard on the 1115), pile delivery (*illustrated below*); and chain pile delivery.

Standard features include: fluorescent light fixture at receiving tray; plate and impression cylinders chrome plated for optional use of small-size plates. Blanket cylinder nickel-plated; adjustable grippers from 3/16 to 5/16 in. on impression cylinder; six synchronized grippers receive sheet from impression cylinder, transport it to receiving tray; ink unit is removable for quick color change; automatic "throw-off" mechanism stops blanket inking when sheet fails to pass onto impression cylinder. Automatic feeder has two suction feet. Capacity: 5000 sheets 20-lb. bond. Pin-bar or oval-serrated plate clamps are standard. Unit has two 1/3 hp 110V AC motors. Speed range: 3400 to 7200 IPH, operator selective. Smallest and largest sheet sizes: 3 x 5, 11 x 15 in. Maximum image area 9¾ x 13¾ in. The machine will accommodate 11-lb. to 2-ply card stock. Jogger delivery model is 50 in. high; requires 61 x 28 in. of floor space. Weight 740 lbs.

Available attachments are: ink roller washing device; and motor driven blanket washing unit. Various other accessories are available. Price: $3410, jogging delivery; $3945, pile delivery; $4125, chain delivery.



Photostat Model 1115

PLATEMAKING

(SHORT CUTS)

The constantly increasing paperwork volume has caused a continuing search for short cuts in production methods. We at Lockheed Missiles and Space Division have suffered beyond most companies due to the rapid expansion of the operation and the basic end product being a written report.

It might be well to mention something of the background of our operation. We have several technical publications groups who do the art work, type and edit report material. All reproduction processes are under one manager, though there are a number of units scattered throughout the buildings. Therefore, all reproduction work channels into one organization from many different sources. As you might expect, this generates some schedule problems, and since all time spans are very short, we have had to examine our processes for short cuts. We feel somewhat like the wheel that revolves with constantly increasing speed until centrifugal force causes disintegration; we have not disintegrated yet, but sometimes think we might fly off at any moment.

Standardization

As a first step, in order to take advantage of the equipment we have on hand we reviewed all processes for improved methods or complete discontinuation.

Since each group was typing in a format of its own we attacked that problem first, believing that standardization would help in the photo lab. We designed a form printed in a fade-out blue with specific locations for all common information and a uniform space for text or art work. These were made in standard sizes, 8½ x 11 and 11 x 17 in. The next step was to negotiate with the users to accept this design. After some give and take and a few modifications, we were able to sell the idea to all concerned.

Stripping reduced

With material coming to us in a standard format, stripping was reduced and in many cases completely eliminated. We were also able to utilize our large camera copy board to much better advantage (*Fig. 2*). Material is held on both the copy board and the negative holder by vacuum, allowing a high speed change of both copy and negatives. The negative holder will handle a film 42 x 60 in. so there is no problem in shooting sixteen 8½ x 11 negatives at one time. For processing, the negative is split down the middle with eight negatives in each strip, as shown in Fig. 3.

Multilith masks were made with a grid and a die cut center section. The negative is registered with the grid, taped in place and the center section removed; Fig. 4 is a view of the stripping operation. The die cut center section is held in by uncut tips on each corner. After this is removed a minimum amount of spotting take place. We have our masks printed specially for us with our own format on paper which we supply to the printer. The paper is purchased from graphic arts supply houses. The total cost per mask, die cut, is $.006 each in quantities of 5,000 per order. The printer uses offset for the format and then die cuts on a letter press. The masked negative is taped to the plate at two points at the top, using the holes in the plate for contact with the negative. The tape is folded over on one end to facilitate removal. The same piece of tape is used until worn out.

Ozamatic printer

Plate burning has always been a slow operation, and in order to reduce this bottleneck, we turned to an Ozamatic diazo printer. This is used only for text or line drawing negatives; 133 line screen negatives will show a little softening if reproduced by this method. The printer operates at twenty-five feet per minute, the actual exposure time for a hundred plates is only a matter of about eight minutes. This system (*Fig. 6*) has enabled us to increase our plate making capacity by a factor of ten times. The net result of all the improvements to date is a productivity increase of 300 per cent over our prior methods. The items contributing the most were the standardization of format and the installation of the Ozamatic printer. We are not resting on our laurels at this point but are continuing a search for faster methods. If all goes well we expect to be using a continuous flow camera some time next year.

There is not much use in pro-

(*continued on page* 55)

The first step in short-cutting platemaking at Lockheed Missiles and Space Division was the designing of a standard format for all submitted material. The form agreed upon—with specific locations for common information and uniform space for text and art work—is shown on this page (green-line area). Other innovations are related by Lockheed's Reproduction Supervisor—J. K. Cornell

THIS SPACE FOR CAPTION
Lowest line of caption must be here

Fig. 1 *(below)* Stripping mask for report pages is pre-cut to fit standard format. Fig. 2 *(upper left)* Sixteen pages can be mounted at one time on large camera copy board. Fig. 3 *(upper right)* Large camera negatives are cut in half and processed in strips of eight pages at one time.

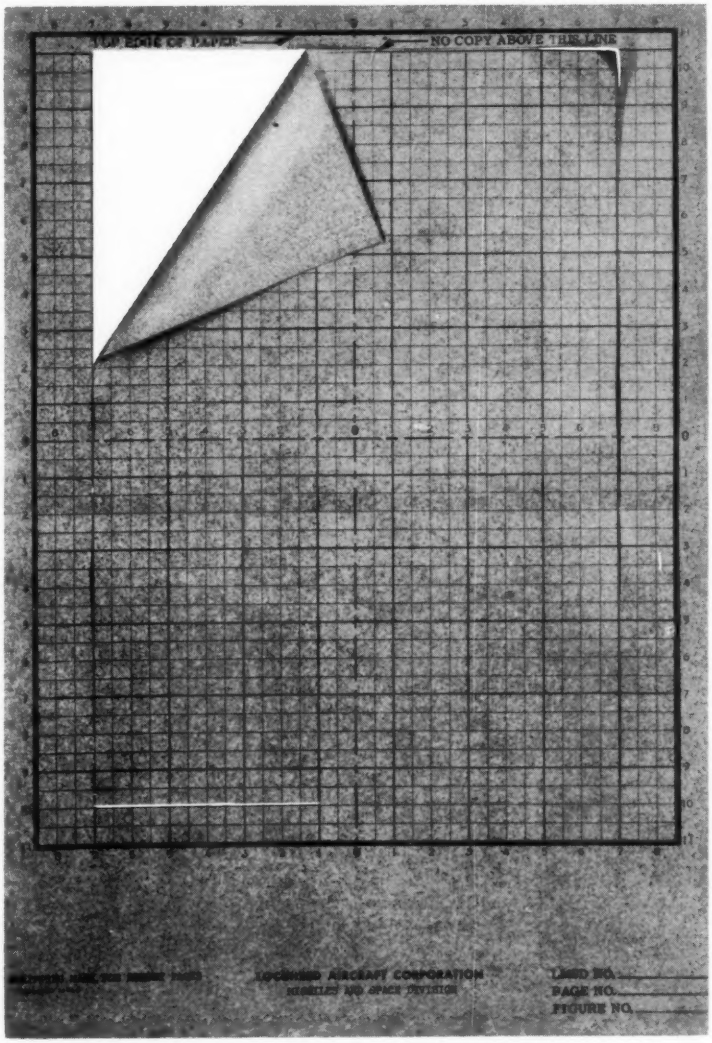


Fig. 4 Negative is mounted in standard pre-cut stripping mask. Die cut center section is held in place by small uncut areas in order to assist in registering.

Fig. 5 Masked negative is taped to plate at two points at the top, using holes in the plate for contact with the negative.

Fig. 6 The plate and masked negative are exposed in an Ozamatic diazo printer, which operates at 25 ft. per min.

THE BENDIX CORPORATION

At Eclipse-Pioneer Division of The Bendix Corporation, a staff of nearly 60 rides herd on a monthly production of engineering document reproduction that runs in the millions with xerography, diazo, blues, offset and microfilm

A sizeable manufacturing concern in its own right, the Eclipse-Pioneer Division is one of dozens of units of The Bendix Corporation. Eclipse-Pioneer, located in Teterboro, N.J., devotes itself to the manufacture of precision instrument and control systems, mostly for the aircraft and missile industries.

It's an exacting trade. One part which may be held in a lint-free, gloved hand costs as much as a sports car, and for the most part it is anything but mass production. No small portion of the costs of anything that Eclipse-Pioneer makes represents the engineering time and effort required to make sure the unit works, before a single finished product is actually turned out. At one stage or another, the engineer commits his final decisions to paper, in the form of a drawing (or drawings) and data sheets. The number of these that accumulate in a month's time is staggering, and nearly all of them wind up in the lap of Eclipse-Pioneer's 50-plus-man Reproduction Department, which grows continually.

Supervisor

Milan Devecka, supervisor of the department, feels he is being conservative when he estimates that the unit produces millions of engineering document reproductions monthly.

Devecka is a 20-year man with Eclipse-Pioneer, and so is his right-hand man, Phil Fink. They report to C. C. Shangraw, executive engineer and J. H. Leggett, director of engineering for the division. The department's costs are part of the overall engineering costs, and no attempt is made to apportion them on the basis of units, or square footage, or the weight of prints, etc.

Devecka is in charge of running the department, and keeping Shangraw abreast of what he needs in the way of men, space, equipment and processes to do so. Shangraw, among his other responsibilities, makes sure Devecka is supplied with his needs and that the Reproduction Department supports engineering with the document reproduction necessary to keep it going. Leggett has the last word.

An example of how this all works was the introduction a few years ago of microfilm reproduction, required for some of the military contracts won by Bendix. Devecka suggested the equipment and trained the microfilm operators. Shangraw brought them together with draftsmen to work out drafting requirements for the new reproduction system, and studied the possibility of incorporating the microfilm method for other engineering drawings, as suggested by the reproduction staff. (It was decided to hold off, awaiting further technology in getting microfilm images back into hard copies, and limit microfilm recordings to material where required by contract and obsolete material, originals of which could be destroyed.) Now that microfilming is a regular service of the department, it's the job of the microfilm operator to buck back any drawings which he feels cannot be successfully reproduced at great reduction. Shangraw, the drafting heads and the reproduction heads are all pleased with the good judgment exercised by the microfilm operators in this respect.

Two processes

The great bulk of the reproductions handled by the department are done one of two ways: by xerographic reproduction on plasticized paper plates, or by blueprint. For the most part, the decision as to what process to use is made or delegated by Devecka, but if an engineer wants any particular kind of reproduction, he gets consideration.

However, the 42-in. Paragon Revolute blueprint machine is used mainly for large drawings or short runs. It runs almost steadily for two shifts a day, five days a week, attended by one man who feeds the tracings in, another who cuts them apart and a woman who rolls or folds the prints for distribution.

If more than ten reproductions are required, and when the document can be reduced to an 11 x 17 format or less, it is usually handled by offset lithography.

Actually Devecka's department has two units regularly in operation for producing offset masters.

One is organized around a Robertson process camera as diagrammed in the pictures (*right*). It's a three-man job. One man handles the copy, sorting the jobs according to size, loading the copy board and adjusting magnification. A list of print sizes and markings on the copy board of the cameras reminds him, should he forget, the proper reduction for the print, and its position on the copy board. He also adjusts the exposure, depending upon the reduction, the copy and the sensitivity of the xerographic plates at the moment.

Second man

The second man in the group operates in the darkroom. His job consists of sensitizing the plate on which the exposure is made with a static electricity charging unit, getting the plate onto the camera before the first man turns on the exposing lamps, removing the plate after exposure, dusting it with the image powder (which sticks to the unexposed portions of the plate, creating a positive image of the original) and passing the plate through a light-tight double-door

pass to man No. 3.

The third man in the group receives the xerographic plate, places it in a charging unit with an offset master, a sheet of plasticized, die-cut paper. This places a static charge on the offset master, permitting it to pick up the image on the xerographic plate produced by man No. 2. Following this, the third man fuses the resinous powder to the offset master in a heating unit, and dusts off the original camera plate for re-use by the man in the darkroom.

What is described of course is the standard application of Haloid's Xerox with a horizontal process camera. The difference in this case is the organization of the job. Each of the three men has almost exactly the same amount of work to perform, and none of them could go much faster unless it were possible to speed up each part of the operation. This would include brighter lights for the camera, faster plate sensitization and faster charging of the offset master and fusing the image. The crew is wringing out most of the speed inherent in the system. Looking at the diagram, one sees that none of the three men has to take more than a step or two to do his job, a most important part of the efficiency.

To give themselves a little variety, and to keep the man in the darkroom from feeling like a mole at the end of a hard day, the three men rotate their jobs at the end of the cycle for the 100th master. Normal production is about 300 masters per shift (which could comprise 600 jobs, because the smaller prints are shot two up) or 600 masters per day.

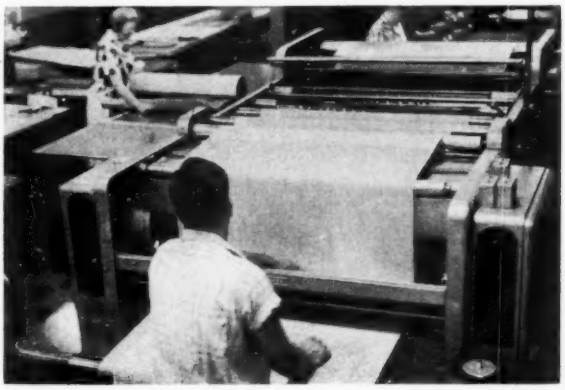
Of course, the system could not work if some sort of registration were not used. The guide lines on the copy board of the camera are worked out to place the final image correctly in the printing area of the offset master. The same is true of the jig which holds the xerographic plate in place on the camera back. It is hinged at the bottom, has an ice box door type latch at the top and neatly clamps the Xerox plate in position in the focal plane with a minimum of effort.

Other little devices for making things easier are racks which hold a half-dozen xerographic plates and fit in the pass-through mentioned previously. When not on the camera, being sensitized, in the transfer machine or being cleaned up, the plate is always in one of these racks, ready for the next step.

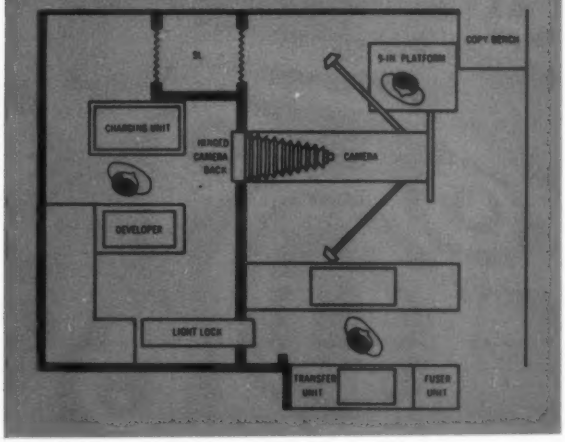
This, of course, is the workhorse of the offset master department, but some distance away, next to the offset presses, is another xerographic installation. This one is used to prepare masters for the 10 x 15 offset press, mostly 8½ x 11 typed documents. A Haloid camera with light-tight holders is used here in lieu of a darkroom, and the copy does not necessitate things

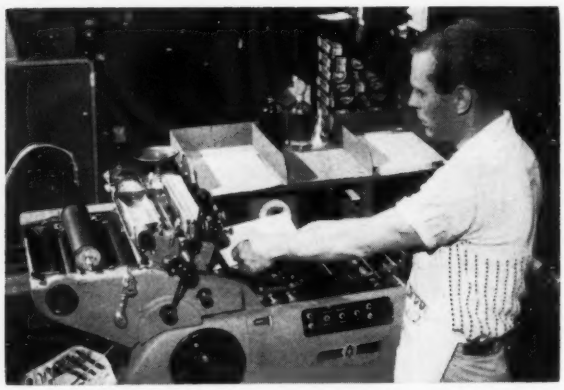
Keeping things straight are engineering, IBM, distribution, record, military clerks. Reproductions get final check here.

Offset masters are made from xerographic plates exposed in Haloid process camera.



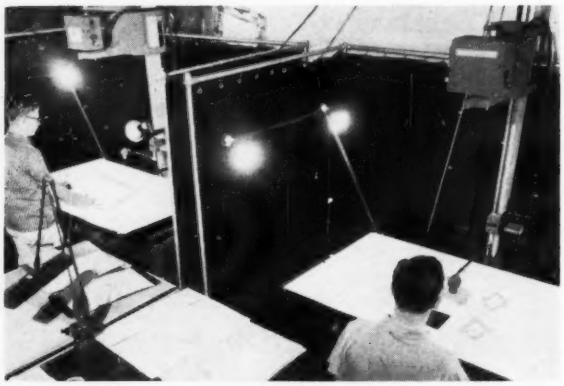
Blueprint machine is workhorse (1,000,000 sq. ft. monthly) for short runs and for originals larger than 30 x 40.



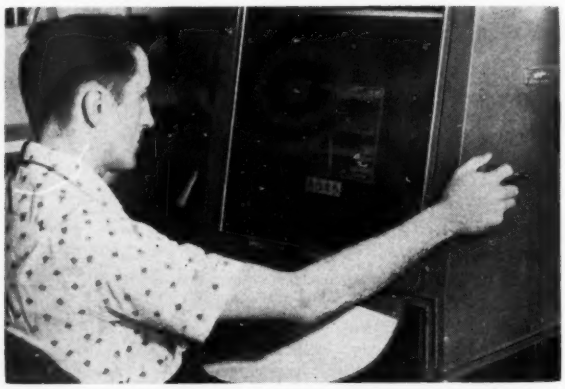


Multi 2550 is latest addition to offset department. Automatic features including press shut-off speed up operation.

Offset equipment includes Miehle press, 1250 Multi, XeroX camera for Multi masters. On table is a paper trimmer.



Defense contracts call for microfilm of engineering documents. Processing and printing is handled on the outside.



Finished microfilm is checked for completeness, readability. More general use of microfilm by department is under study.

being spread out quite so far. Therefore, the Tinkers to Evers to Chance organization is not employed.

This does not exhaust the sources of masters for the offset presses, however. Considerable use is made of direct masters produced with carbon ribbon typewriters. These, however, are delivered to the reproduction department ready to run.

Photo helps out

There is some camera work which Devecka's department does not handle. When a job, with blue lines, or requiring stripping or a halftone comes in, it goes first to Peter Carey's Photographic Department, which photographs the copy and strips the plate. Only the plate exposure is done by the Reproduction Department. The Reproduction Department keeps three offset presses clacking 16 hours a day. There's one Miehle for the 11 x 17 plates and two Multi's, a 1250 and 2550. The group finds the latter especially useful in expediting the heavy load of short run material. A close analysis has not been made, but it could turn out that this unit outproduces a less-automatic but otherwise comparable one by as much as five to one.

Here again the operators rotate jobs, and many of them have piled up experience in the blueprint, diazo, and process camera areas.

Pre-cut stock is used for the most part, in as few varieties as feasible. The two-up jobs must of course be cut apart. A table-model power cutter is used for this job.

Other equipment in the offset department is a much-sworn-at spirit duplicator, as well as a binder, collater, and arc light. Altogether the two shifts turn out something like 44,000 impressions daily by offset lithography.

Devecka feels that for his operation, the offset and blueprint methods provide the greatest economy, but diazo reproduction is by no means neglected, nor is photocopying.

One diazo machine is stationed among the files near the service desk, for quick whiteprints. Others are located near the blueprint machine. Much of the diazo work is making black-line or sepia intermediates. These serve as a basis for a revised tracing to be reproduced by means of photolithography or blueprint.

No necessary job is refused, however, and if Devecka's department is too snowed under to handle a specialized one at the moment, they'll send it to an outsider.

Two types of photocopy are employed: Photostat and a DTR Apecostat. The latter is preferred for same-size positives.

The microfilm equipment in use

presently comprises two 35mm planetary cameras with exposure devices, a densitometer, a microscope and a film reader. All the photography is done at Eclipse-Pioneer, but the processing is handled by an outside source.

Inspection

The microfilm operators photograph a National Bureau of Standards resolution test chart at the head and tail of each roll, and at times in the middle. Reductions are according to specification in the contract covering the project. Each roll is inspected on the return to Bendix for resolution, background density, physical condition, readibility and completeness.

The notion of expanding the use of the microfilm image to other than contract work and space saving of obsolete and superseded drawings is by no means dead at Eclipse-Pioneer. Devecka, Fink and Shangraw are watching developments in active file microfilm closely.

Central file

Besides being a reproduction unit, the department serves as the central file for engineering drawings. The traffic in the file is quite heavy. Three girls on the second shift file about 2400 drawings nightly. Requests (which may involve a number of documents) run about 500 monthly for prints and about the same number for original drawings. The entire file is kept in a fireproof vault adjacent to the clerical and blueprint areas. The documents are filed numerically.

The clerical work includes logging, filing, record keeping and distribution. A special job classification, military clerk, was established for each person who keeps tab on contracts involving classified material. Two girls are kept busy on the day shift delivering prints in supermarket wagons.

Quick delivery

Devecka would like to give almost instantaneous delivery on any request, but the department is not quite up to the impossible as yet. Normally however, even the most involved operation does not take long. Jobs that reach the process camera in the morning are often stacked up for distribution in the offset press room at the end of the first shift.

Almost without exception, the reproduction workers come to Eclipse-Pioneer without previous experience in the field. Among the men on the staff are a college student and a retired army man. They usually start out at the simpler jobs, e.g. trimming blues, and are gradually broken in on each of the jobs. As a result, most of the employees with a few years' experience under their belts are equipped to handle any of the processes used. This would seem to make the unit a training ground for outside employers, but actually the turnover is relatively low, according to Devecka. Bendix has a good reputation for employee relations.

The demand for engineering document reproduction is growing steadily, and the size of the staff and the equipment does not trail far behind. Devecka and Fink keep a weather eye on new products and processes for ideas that will enable them to increase production, quality and speed.

The maintenance of quality standards in the department is not a major problem. For the most part, there are but a few variables that require close watching and the basic requirement is fairly simple, namely, that the reproduction be a readable and complete record of the original document.

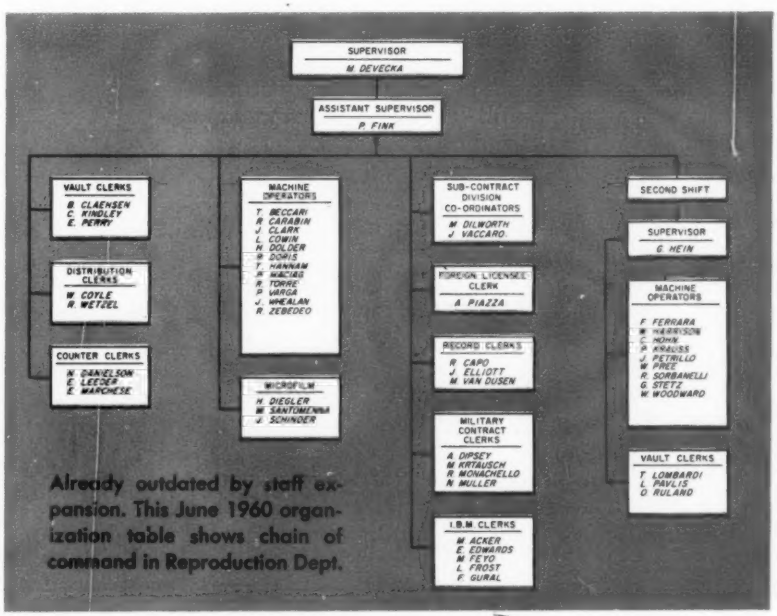
In the case of the offset masters, the image is checked on the xerographic plate, and when transferred to the offset master—within minutes after exposure. Makeovers are rarely necessary, but are nearly always decided upon at this stage. Should a sub-standard master slip through the crew at the camera it would still have to run a gamut of sharp eyes in the offset press room, drafting department and eventually engineering.

Much the same is true of the diazo, Photostat and photocopy work.

Outside processing

The exception to the rule is the microfilm operation. An outside vendor does the processing and printing, so that there are not only more variables altogether but fewer are under the control of Bendix. Furthermore there are precisely stated quality standards set up for the microfilm in the contract covering the project. The five point quality check described earlier was set up, and the microscope and film reader purchased to implement it. The checks have shown that the films are consistently within contract tolerances and equal to or above quality specs.

Devecka and Fink drive themselves hard. Like many reproduction departments, there's too much to do for anyone to indulge himself in much idleness without standing out like a sore thumb. But none of the staff seem to regret being kept busy eight hours per day, and morale seems to be good. Perhaps the rotation system helps keep interest high, but in any case there seems to be a real pride and interest in the work.—THE END



Already outdated by staff expansion. This June 1960 organization table shows chain of command in Reproduction Dept.

SELLING THE BROOKLYN BRIDGE

The assignment was to produce a mailing piece for our company, Lukens Steel, which would reach the limited number of people who influence bridge design. This small group is flooded by mail, all including bridge pictures. No conventional photograph would have the stopping power to attract the attention of these sophisticated bridge designers.

If we could not use a conventional picture of a bridge, why not use an unconventional picture? The result was a picture which was based on a photograph and with many of the steps involved being done photographically. Its appeal can be measured by the extremely high response, 42 per cent in the first year of mailings. This series of mailing pieces has been favorably mentioned in the advertising journals and the number of requests received for copies for framing is very gratifying.

The first step in the production of this picture was to make a photograph. The picture was made by Fred S. Frater who does the major part of advertising photography at Lukens Steel in Coatsville, Pa.

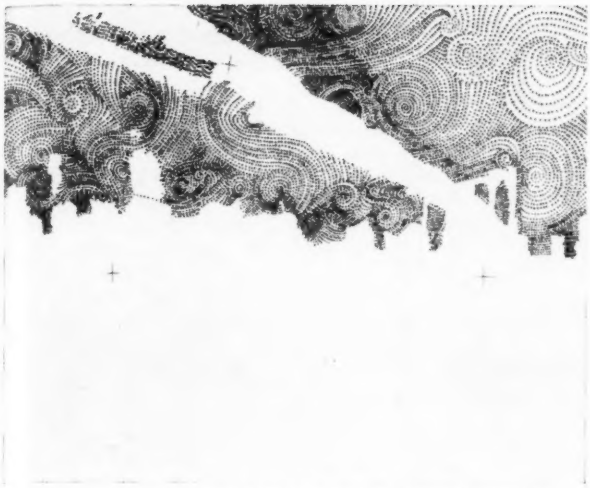
A piece of vellum (tissue paper can also be used) was placed over the photograph to serve as a guide for the artist. A dotted texture technique was used, applying the dots on the vellum and overlapping the image to facilitate registration.

The completed vellum overlay, consisting of a pattern of dots applied by an artist, was then reduced to the size of the original shot of the bridge on 4 x 5 Ansco Reprolith film.

Meanwhile a contact print of the original continuous tone negative was made on 4 x 5 Reprolith. This amounted to a high contrast transparency which converted the continuous tone negative into a line (*continued on page* 55)

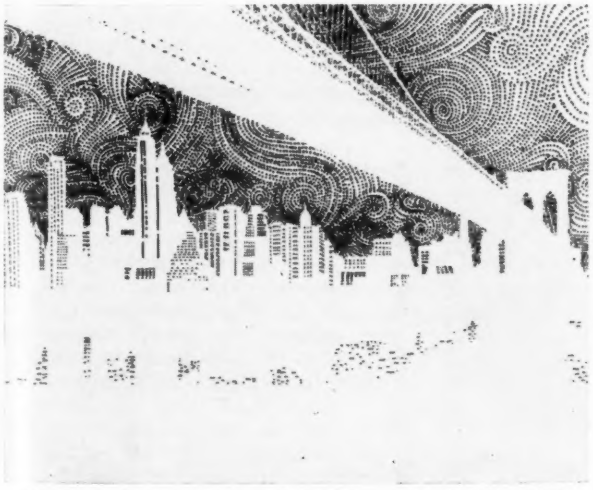
First step was to shoot a continuous-tone photograph

Vellum was placed over photograph and dot pattern applied

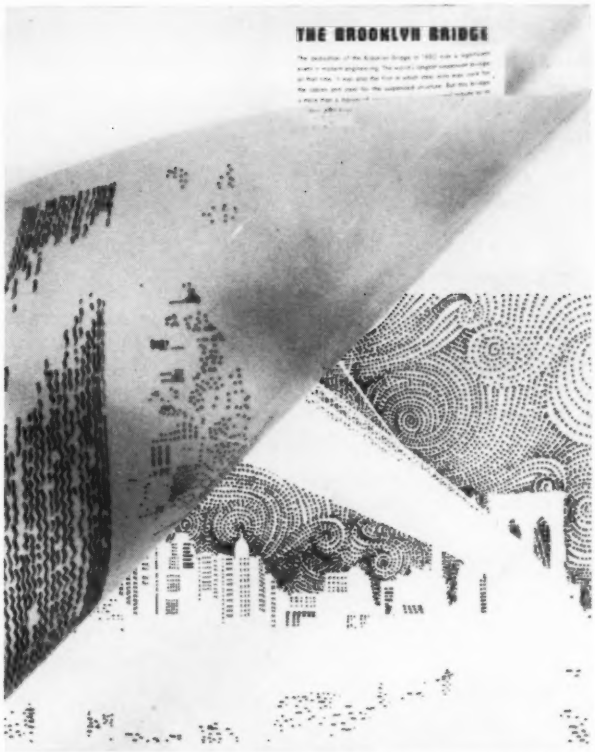


Completed vellum was then shot on 4 x 5 Ansco Reprolith

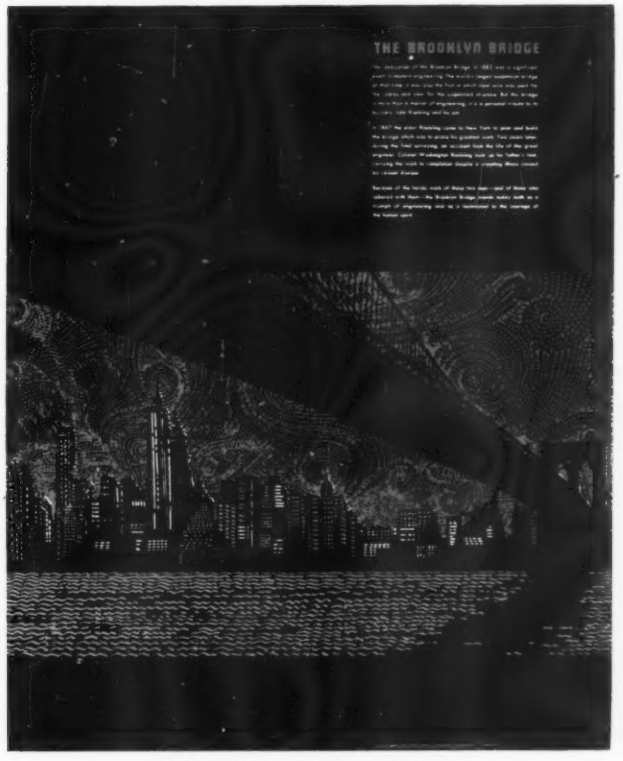
Reprolith positive contacted from original 4 x 5 negative



Two Reproliths were placed in register, producing this print



Type copy placed on photograph; both pasted on mechanical



Finished job ready for mailing

QUICK COPIES 3½¢ ea.

IBM Poughkeepsie finds that a camera plus a diazo machine equals quick, low-cost pictures for reports

One of the most common paper work problem areas encountered today by research and production departments is the written report. Generally these reports are of a confidential nature for use by company personnel and management only. Hence the beauty of layout frequently leaves something to be desired, since legibility is considered paramount to the beauty. The prime factors which determine the final form a report will take is usually dictated by several items, the most important of which are: how much money will be spent on producing the report, how much time is allowed for the preparation of the finished report and how many copies are required.

At IBM's Poughkeepsie Product Testing Laboratory the technical report is turned out quickly, economically and with a simple layout form with resultant high degree of legibility and readability. Product testing uses several methods of reproduction after they have typed their reports on vellum masters. They reproduce these either by the use of the diazo method or the Xerox method. In addition they sometimes type directly on paper plates for immediate use on offset duplicating equipment. In this particular division of IBM their reports have a high percentage of illustrative material which must be incorporated within the framework of the reproduced report. They solved the problem of combining pictures with words by preparing a screened positive transparency which could be stripped in on the typewritten report page for subsequent reproduction on a diazo machine.

Equipment used

The equipment utilized for this system consists of a Bruning Copyflex diazo-type reproduction machine (Model 250), a Kodak 4 x 5 Masterview II camera, two light stands with No. 2 reflector lamps and an Omega D-2 enlarger. Since IBM has several photographic installations the Bruning machine was the only extra piece of equipment needed for the job by the testing laboratory.

As soon as a test engineer has completed the testing laboratory report it is typewritten on standard 8½ x 11-in. vellum paper which is carbon backed during the typing to insure sufficient density for the diazo printer. Wherever an illustration is specified an area is left blank to permit stripping in the screened transparency. At IBM they have pretty much standardized on a 4 x 5-in. format for illustrations because the screen positive transparencies can easily be made by contact printing the camera negative on Kodalith Autoscreen Ortho continuous tone film. They do this directly on the easel of the Omega D-2, holding the camera negative and Autoscreen film flat with a sheet of plate glass.

When a positive transparency is to be reproduced, the emulsion of the halftone transparency must be next to the emulsion of the sensitized diazo-type paper. As a result, the camera negative must be reversed during the contact printing so that the Autoscreen positive reads correctly when reproduced on the Bruning machine.

Should it be necessary to enlarge or reduce a picture the D-2 is used in the conventional manner—projecting the image on the Autoscreen film. A flash exposure is also necessary to control contrast of the Autoscreen positive. They do this by exposing the Autoscreen material briefly to the filtered light from a yellow darkroom safelight, Wratten series OA.

When processing the positive transparency in standard developing solutions they make the transparencies a bit on the dense side in order to meet the requirements of the printed matter. The Bruning machine requires an overexposed film positive for optimum reproductions. Just what degree of overexposure was determined by trial and error. They find that the 133-line screen which is built into this film is highly satisfactory for this type of reproduction. (A halftone engraving made directly from one of the screened diazo reproductions is illustrated, on the right hand page.)

Light backgrounds are best

To retrogress one step, it is worth noting that they try to shoot all the product pictures for the reports against a plain white background. This serves a dual purpose. First, it adds clarity. Secondly, important caption material can be included within the 4 x 5-in. format. An illustrator can print directly on the clear areas of the positive transparency. If it is not possible to use a white background—and this condition could exist when the parts or subjects are light in color—the negative is Leroy lettered before the positive transparency is made. Thus, white lettering is produced on a dark background. Occasion-

ally the Leroy lettering technique is employed directly on the typewritten report page.

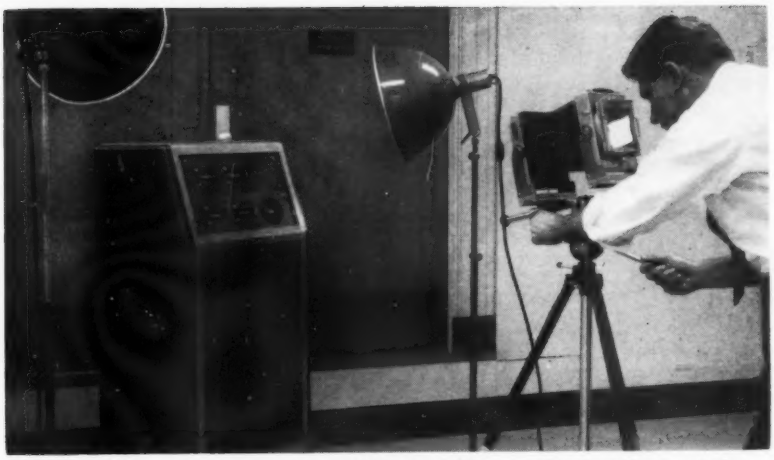
After the positive transparency has been completed, it is inserted into the space provided for it. This is done simply by cutting out a window in the page and taping the transparency in place with clear cellophane tape. At this point the page is ready for reproduction. If black-and-white copies are to be made, 8½ x 11-in. No. 20 Bruning Copyflex paper is used. The typewritten page, with photos in place, is put face up on top of the sensitized paper. Then both sheets are inserted into the diazo machine.

Although the Copyflex machine used at IBM is a high-speed unit with a maximum mechanical speed of 30 linear ft. per min., it is operated at a speed of only 12 to 18 ft. per min. depending upon the speed of the Copyflex paper. If the page were to be run at too high a speed, the marks from the tape that holds the halftone in place would show on the copies.

Brown-line intermediate copies of the photo reports are made as part of the initial run so that the receivers of the report may reproduce black-and-white copies on Bruning if they so desire. No. SF-20 Bruning Copyflex paper is used for any master at a speed of 12 to 18 ft. per min. When a black-line copy is made from a brown-line intermediate copy, the machine is run at a rate of 10-14 ft. per min. for this function and to achieve best results. In the latter case, the typewritten master is placed face down on the emulsion side of the brown-line paper.

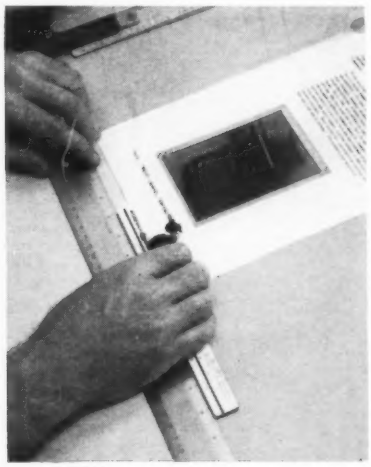
Short run reports

Most of the reports reproduced by this method at Product Testing are for short runs of 20 to 30 copies only. During the initial analysis of the system it was estimated that the conventional "print-paste-up" method would cost about $9 for 30 copies. Via the diazo-type method and a single halftone transparency, 30 black-and-white copies cost approximately $1.05 or 3½¢ each (cost of materials only). The time factor is reduced and additional copies can be run off at any time. This helps relieve the work load on the photo section since they have to make only one positive Autoscreen transparency instead of a lot of enlargements or contact prints.—THE END



Lighting and camera set-up used at IBM's Poughkeepsie Product Testing Laboratory is straightforward. Kodak Masterview II and two reflector lamps are employed.

Screen positive transparency is made in darkroom with Omega D-2 enlarger.



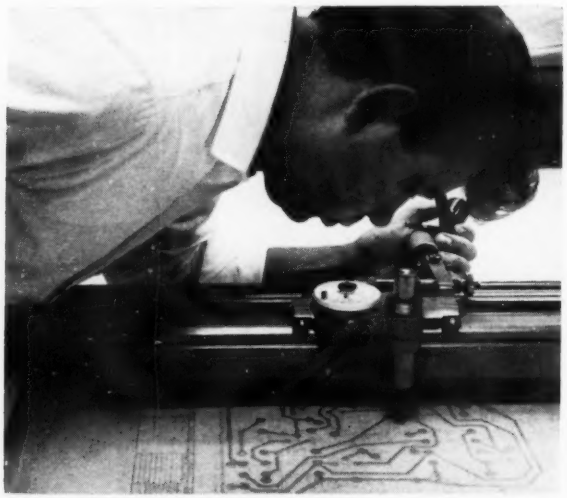
Leroy lettering is use for caption when picture backgrounds are dark in color.

Final report pages are produced from masters run through diazo machine.

Engraving above was made directly from a diazo copy of report page.

PHOTO CIRCUITS INC.

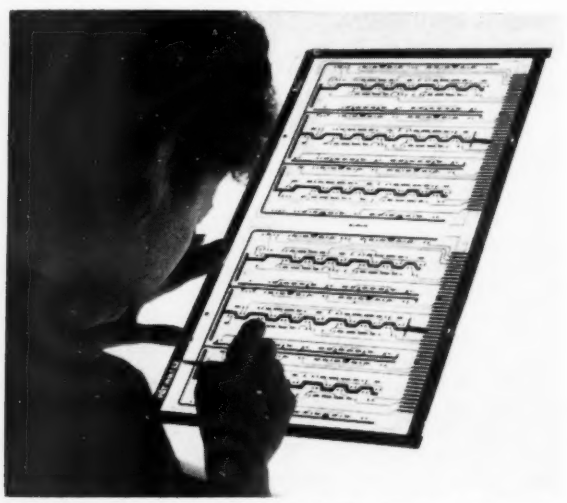
In this business, even basic methods become trade secrets. Here is an exclusive report on how one of the largest firms in the field works



Coordinatograph is used by draftsman to check pad location on black-and-white master drawings. Micrometer scales permit accurate plotting to .0015-in.

Pat Clohessy rotates copyboard of Lanston horizontal process camera into exposure position. Exposure is made on Kodalith Type 3 glass plates.

Plates are processed immediately after exposure and examined visually for any imperfections. Coordinatograph and calipers are used for checking plates when dry.



Multiple circuit layout gets final opaquing and touching up prior to photoprinting or screen making operation. Plate shown has 6 identical circuit patterns.

The Photocircuits Corporation in Glen Cove, N.Y. is one of the larger producers of etched circuits in the United States. While some of their techniques are closely held trade secrets, most of their photographic operations are standard photomechanical methods. What makes them unusual is the fact that they handle such a diversity of circuits, in a large volume—and are willing to talk about it. For the most part, this is a pretty close-mouthed business. Behind the secrecy is an infringement suit that is apparently a test case. Plaintiff, Technograph Printed Electronics, Inc., Winston-Salem, N.C. is a holder of rights to numerous patents in photomechanical applications. Defendants are three firms alleged to be producers and/or sellers of printed circuits without observing the proper formalities. The defendants, on the other hand, seem dubious about the patent claims. Photocircuits is one of 14 licensees of the patent holders, and therefore happy to admit that they do indeed carry out what their name implies.

Besides its original etched circuit operation, Photocircuits has an offshoot, the Proto Division whose primary function is to turn out short run prototype boards for their customers. Generally speaking this takes several days but under certain ideal conditions they could turn out a board in a day. Other divisions include one that turns out high performance compact electric motors whose armatures are made using printed wiring techniques. The firm is happy about the expansion possibilities.

The motor mentioned above is the DC Printed Motor which utilizes a printed circuit for the armature, instead of an armature with the conventional wire windings. The Printed Motor armature is a two-sided printed circuit with plated through holes to carry the heavy current required. These motors have a high torque to inertia ratio and a very fast response.

Out of the Printed Motor interest came the development of a photoelectric tape reader which utilizes the Printed Motor. Just what will come next is anybody's guess, but you can be sure something new will turn up.

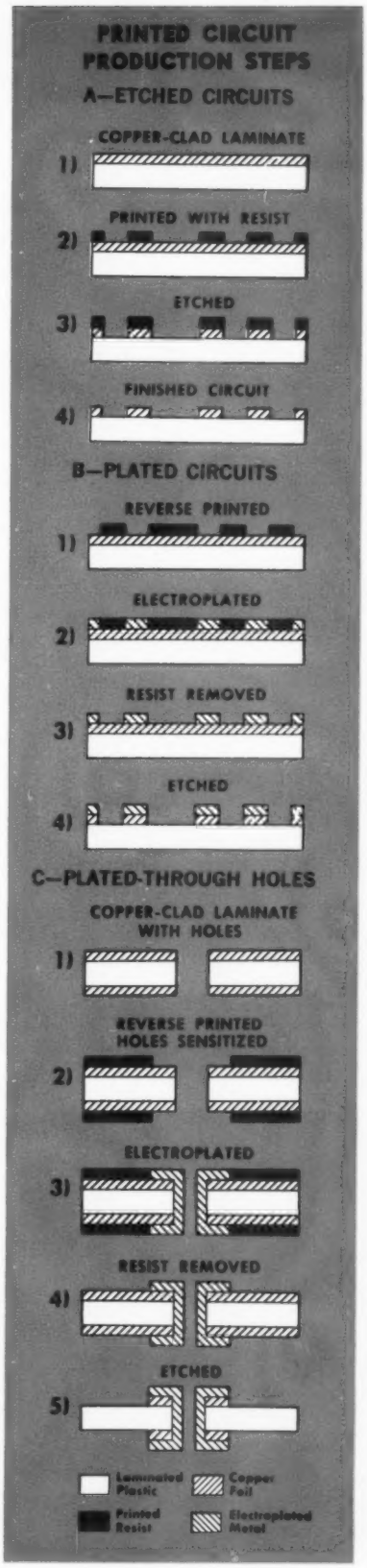
The first step in any producing printed circuit is the master drawing. At Photocircuits it is prepared on a dimensionally stable base material such as .005 and .007 Mylar. The drawing or the equivalent may be done in india ink or with precision cut adhesive tapes. Many customers supply tape masters but Photocircuits people prefer the ink drawings. They feel that with tape the terminal pads and the circuitry in general cannot be laid out as accurately as with ink. This includes spacing and front-to-back registry. Frequently, tape does not photograph with satisfactory definition. Changes and extensive rework are usually impractical unless the master was made with special care using selected materials. Some of the tapes have a tendency to creep, especially curved patterns. This is a most disturbing factor in a two-sided or multi-layered board with plated-through holes. In both of the companies divisions the customer's master is not only the first step, but frequently the first headache. Frequently they have to be redrawn completely because of inaccuracies. The firm recommends that drawings be at least twice the size of the actual board and a four to eight times original is preferred. Lastly, Photocircuits insists upon one long critical dimension to which the master drawing is to be reduced. The photographic elements are produced to within 0.002 in. of this one long dimension.

Coordinatograph checks

One of the most useful instruments used at Photocircuits is the Haag-Streit Coordinatograph (distributed in this country by Aero Service Corp.) which accurately locates points on the master so long as its two coordinates are known. The unit, which is mounted on a table, has a 10X scope for visual checking and pin-prick device which locates a point within a stated accuracy of 0.0015 in.

Before a drawing is released from the drafting area, all dimensions are carefully checked with the coordinatograph. Once a drawing has been released it is ready for the camera. Bob Johansen is Proto's head cameraman and Pat Clohessy supervises the camera operation for the Photocircuits production operation.

The black-and-white master drawing is placed on the conventional copyboard of the Lanston camera. Tape masters prepared on translucent base material are mounted on a diffusion screen transparency holder and the lights



are moved behind the copy. The back-lighting method for tapes eliminates fuzzy edges and reflections from the tape surface, which occur when lighted in the conventional manner with incident light.

The first shot with the camera is always made on glass plates. Kodalith Type 3 Ortho plates .130 in. thick are employed. 8 x 10 and 11 x 14 are most commonly used. However, they do use up to 20 x 24 plates at Photocircuits. During the focusing operation the cameraman checks the critical dimension on the drawing directly on the ground glass with vernier calipers. Although a 0.002 in. tolerance is permitted special care is taken in order to minimize the reduction error. A tolerance of .001-in. and smaller is usually achieved.

The plates are processed in Chemco's Powerdot and Powerfix solutions, wiped dry and put into a drybox.

Next step in the photographic process is contact printing the glass plate negative. Dimensionally stable film is used only for short run boards but glass plates are preferred for most of the work.

All the contact prints are made and processed at the same time to insure uniformity.

This copper-clad material is sensitized with Kodak Photo Resist (KPR) solution. Photo resist is applied in the conventional manner using a plate whirler, heat lamps for baking the plate etc. The plate is then exposed with one of two contact printers. Mercury vapor lamps are used to execute this exposure. The printer for two-sided boards has lamps both above and below the glass negative stage.

Following exposure the undesired areas on the plate are etched away in an acid bath. The printed circuit board is then ready for the customer if the job has been a single print and etch board. In the production operation the photoprinting technique is seldom used. Instead screen stencils are used.

Production's camera work

The photographic techniques employed in Pat's production unit differ somewhat from those used in Proto. The first shot is made on the Lanston but then a multiple circuit layout is photographically composed on a 20 x 24 glass plate by means of a Rutherford step-and-repeat machine. This manually-operated unit is a massive machine which occupies a room all by itself. The master plate is accurately aligned and is locked in a jig which is then held in contact with the large glass plate. The image is stepped horizontally across the plate and then lowered the desired distance and stepped across again.

The machine settings are determined by Photocircuit's methods department and the operator follows their instructions. It is possible to rotate the image with this machine and asymmetrical circuit patterns are frequently stepped in an interlocking pattern.

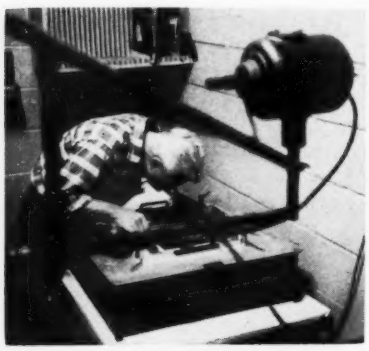
Once the plate has been processed and the critical dimensions checked, it goes to the screening section. Here they have two methods of preparing the wire screens for printing onto phenolic paper and epoxy-base materials. One consists of coating the front and rear surface of the wire screen with a PVA (polyvinyl alcohol) solution which has been made light-sensitive by the addition of a bichromate substance. The number of coats required depends upon the number of impressions required from the stencil. Once the coating has dried the glass plate produced by the photo section is placed in contact printer with the sensitized wire screen and exposed to a carbon arc lamp for approximately 5 min. Next the screen is developed and washed with warm water which removes the unexposed PVA. The stencil is dried and ready to print.

Pre-sensitized stencils

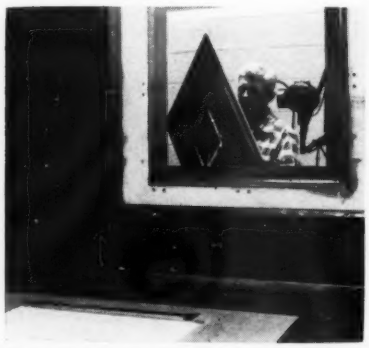
The second and more extensively used method of making the wire screen stencils employs one of the many pre-sensitized stencil materials. In this case the pre-sensitized sheet is contact printed as mentioned above, developed, washed with warm water and transferred from its backing sheet to the wire screen. The screens used are 200 mesh per in. stainless steel wire. The diameter of the wire is .002-in. These screens are mounted in rigid metal frames which measure 18 x 30. This is sufficient for most of the stencils since the standard panel dimentions used are 12 x 24.

The printing operation is done by hand with specially-built screening presses. They built their own presses at Photocircuits to meet the task at hand. Each has a vacuum panel holder and a set of adjustments for accurate positioning of the circuits on the panels. After printing the panels are baked to dry the ink and then sent to the plating and etching sections.

After screening, plating, etching, etc., the boards move on to the fabrication area where the printed circuit boards are punched, die-cut, drilled and otherwise completed for the customers.—THE END



Master plate is aligned in jig of step-and-repeat machine. Point light source is shown in foreground.



Once aligned the jig is mounted in the Rutherford machine for stepping circuit pattern on glass plate.

Rear view of machine shows jig in position, vertical and horizontal movement controls are at right.

OFFSET COLOR

(*continued from page* 23)

This insures maximum density blacks and bright clean whites. It is necessary to print a very heavy lay of ink in all three colors to make up for the lack of a black printer, which is normally used in four-color printing to add the drawing required for fine detail and so strengthens shadows. This makes it essential that a "no-offset" spray be used at the delivery end of the press. The lay of ink put on the paper is controlled by checking the density of the tint strip that appears on each plate and hence on each sheet of paper that is run through the press.

The value of the tint has been so chosen as to print a 70 per cent dot. This strip, about ⅝-in. wide and a little longer than the form (the printed picture) is wide, is printed across the page at the bottom. It will be trimmed off later.

A reflection densitometer is used to read the density of this strip. The density must be held within about ±0.05 density units to insure consistency in the process from job to job. As the press runs, the press operator periodically pulls a test sheet from the delivery tray. With a quick check of the densities at various points across the width of the tint strip, he can determine the side-to-side evenness of his ink lay as well as the heaviness of his average ink lay. Both of these must be controlled to guarantee a good printing job.

The yellow image is printed first and is followed by the magenta image, after the yellow ink has dried. It is usually necessary to make the color runs no sooner than one day apart.

The cyan image is laid down last. Its heaviness can be varied to some degree in order to compensate for minor deviations in the lays of the first two colors. Visual examination of the press sheets during the cyan run and comparison with the original transparency will suggest any changes to be made on the press.

If a caption is to be run in black, it can be done after the three-color image has been laid down, or before any of the color is laid down. The latter method is preferable if trouble has been encountered with the paper changing size after it has gone through the press once. The moisture picked up on that first time through will sometimes produce a size change in the paper. This causes trouble in registering the magenta and cyan images to the yellow. Running the black first will wet the paper and cause the size to change before any of the colors is on the paper. Better registration between the three colors is then more likely.

The inks to be used in this process must be chosen with care. They are not the so-called process color inks. Instead, they are inks which have been specifically designed to work well together for three-color rather than four-color reproduction. They are a more ideal set of inks than one usually encounters in four-color process work. They eliminate the need for extensive color correction. They cost a little more (but they do so much more). The references in the paragraph at the conclusion of this article contain the names of inks suitable for this process, as well as other specific technical information.

One of the most useful aspects of the short-run three-color process is that it has been designed for use with the office duplicator type of printing press (offset press). A machine of this type is available to the photographic department of most industrial organizations. This precludes the necessity of a large capital expenditure just to make a try at the process in a small way. Two modifications to the standard machine are very helpful in simplifying registration adjustments. These are the insertion of a pair of registration pins on the plate cylinder for use in positioning the plates, and some means of making very small longitudinal and transverse adjustments of the plate and/or paper for minor corrections. Consistent registration of the image on the paper to within about 0.003-in. is required.

To conclude this rather sketchy introduction to the short-run three-color process a few words about personnel are appropriate. Any color printing system is extremely demanding on the operators who actually do the work. A system such as the one described is even more demanding than most. It has been called the *simplified* short-run three-color process. This simplification results from standardization. It is imperative that if it is to be simple (hence inexpensive) the standards set up for the process must be rigidly adhered to.

It has been my experience that to put such a system into operation with competent personnel, takes about three months of fairly steady practice to turn out satisfactory quality consistently. By "competent" is meant a photographer already trained in the making of black-and-white halftone negatives and a press operator who knows his press and who can print good black-and-white copy.

During this start-up time, a considerable amount of careful experimentation must be done. These two people work closely together as a team, each striving for consistency in his end of the operation. A change made by either one in his technique should appear in the end result. Inconsistency on the part of the printer will obscure the effect of a deliberate change made by the photographer. The photographer must also be consistent and exacting in meeting his standards. Otherwise changes made by the press operator will be difficult to evaluate.

Once the system has been developed and perfected for a particular shop, it does not take more than several weeks to train new workers to function in the process, if they are already competent in their photographic and printing skills. It takes longer to train a press operator than a photographer for color lithography.

Success in the process, meaning quality with economy, depends on three things.

1. Rigid adherence to standards in the exposure and processing of masks, separation negatives, and offset printing plates.
2. Use of mechanical pin register systems throughout.
3. Use of special three-color inks and controlled lay of ink using tint strip and reflection densitometer.

The references that follow contain much more information on the Simplified Short-run Three-color Process than could possibly be mentioned in this short article. Any industrial photographer who seriously considers going into this kind of reproduction should become very familiar with them.

And even more useful to the novice in color lithography is a service available in Rochester through the Eastman Kodak Company. At the State Street offices the Graphic Arts Studio offers a free two-day course in the fundamentals of color

(*continued on page* 50)

FREE LITERATURE

For your copy of any free literature item, circle the appropriate number on the readers' service card, attached, page 47.

GRAPHIC ARTS

KENRO CAMERAS **201**
Kenro Graphics, Inc. Illustrated brochure to assist potential users of the Ektalith Method in selecting the correct camera. Includes bulletin with details and prices on the Kenro "Vertical 14," "Vertical 18" and the "Vertical 24."

REPROPORTIONING CAMERA **202**
Process Cameras & Equipment, Inc. 4-page illustrated folder describes the Clydesdale Reproportioning Camera. Lists prices and all accessories available.

PROCESS CAMERAS **203**
Process Cameras & Equipment, Inc. 12-page illustrated catalog describes the Clydesdale line of process cameras. Includes prices and list of accessories.

TRANSFERMATE CAMERA **204**
M. P. Goodkin Co. Brochure describes the Goodkin Vertical 18-in. TransferMate camera specially designed to meet first-step photographic needs of Ektalith, Gevacopy, other matrix-transfer process.

AUTOMATIC PROJECTION HEAD **205**
Wollensak Opical Co. Illustrated specification sheets describes the Haloid Automatic Projection Head for the Xerox Copy Flo Continuous Printer.

AUTO FOCUS VERTICAL CAMERA **206**
W. A. Brown Mfg. Co. 4-page illustrated folder describes the Ensign auto focus vertical camera. Includes specifications and optical accessories.

KLIMSCH REPROCOLOR **207**
Repro Graphic Machines, Inc. 4-page illustrated brochure describes the Klimsch Reprocolor accessory for horizontal process cameras for making enlarged reproductions from small transparencies. Includes specifications.

XENON ARC EQUIPMENT **214**
American Speedlight Corp. 8-page illustrated leaflet lists the Ascorlux line of xenon arc equipment including color balanced white lights, camera lamps, printing lamps, photo composing machines and projection or enlarger optical systems—condenser type.

VERTICAL CAMERA **208**
M. P. Goodkin Co. Illustrated specification sheet gives complete information on the Goodkin Vertical 24-in. Camera. Also lists option equipment and price.

PRICE SCHEDULE **209**
Miller-Trojan, Inc. 30-page illustrated price schedule gives prices for complete Miller-Trojan line including cameras, darkroom accessories, layout tables, arc lamps and plate makers. Also given are complete specifications.

ROBERTSON "481" **210**
Robertson Photo-Mechanix, Inc. 4-page illustrated brochure describes in detail the Robertson "481" camera. Includes complete specifications.

OFFSET PRESS **211**
Copease Corp. Illustrated catalog sheet describes the Copilith Jr. offset press. Gives complete specifications.

COLORLITHO PRICE LIST **212**
Colorlitho. 6-page price list gives rates and general information on color services available from this New York firm. Services include catalog sheets and custom color brochures from your color negatives, transparencies or artwork.

LIGHTING **213**
ColorTran. 22-page illustrated catalog describes ColorTran lighting available for still and motion picture photography.

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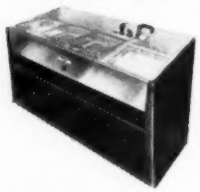

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GRAPHIC ARTS CATALOG 215
Ilford, Inc. 46-page catalog lists graphic arts materials available from Ilford including plates, films and filters. Includes sections on recommended techniques and materials and chemicals and formulae.

METAL-ETCH RESIST
Eastman Kodak Co. 16-page illustrated booklet gives complete information on etching, chemical milling and plating with Kodak Metal-Etch Resist. Includes sections on general procedure and applications. For your copy write to Eastman Kodak Co., Graphic Arts Div., Rochester, N. Y. Specify Pamphlet No. P-36.

CONTROLLED COATING 217
Frederick Post Co. 4-page illustrated folder gives important facts about controlled coating for sensitized papers. Also lists Post's line of controlled coated papers.

CONVERSION FACTORS 218
Precision Equipment Co. Wall chart contains reference table of conversion factors. Included are conversions such as inches to centimeters, atmospheres to Kgs/sq. cm., cm/sec. to miles/hr. and microns to meters.

GRAPHIC INFORMATION
Gevaert Co. 20-page magazine *Reprorama* features article on Gevaert polystyrene film base, includes a tabulated guide to Gevaert graphic plates and films. To get your copy write Gevaert Co. of America, Inc., 321 W. 54th St., New York, N. Y.

FILM AND FILTER CHART 220
Ansco. Wall chart gives detailed information on filters to use with Ansco Reprolith films for color copying.

APPLICATION CHART 221
E. I. du Pont. Wall chart for Cronar graphic arts films lists films to use for halftones, line copies, continuous tone copies in black-and-white and color. Includes brief description of each film.

ESTAR BASE FILMS
Eastman Kodak Co. 12page booklet on Kodak's estar base films for the graphic arts includes sections on dimensional stability properties, mechanical properties and thermal properties. For your copy write to Sales Service Div., Eastman Kodak Co., Rochester, N. Y.

INK SAMPLE BOOK 223
Polychrome Corp. Pastel and metallic ink color sample book contains formulas for mixing pastel shades from standard Chromatone inks. Includes nine high gloss metallic colors.

HALFTONE DOT DETECTOR 224
nuArc Co., Inc. Illustrated catalog sheet describes the Halftone Dot Detector. Gives specifications and prices.

PLATEMAKING EQUIPMENT 225
Robertson Photo-Mechanix, Inc. 4-page illustrated leaflet describes the complete line of Dycril platemaking equipment including the plate conditioning cabinet, flat plate exposure unit, rotary vacuum exposure unit and plate washer.

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FREE LITERATURE

(*continued from page 45*)

MICROFILM OPERATION 238
Minnesota Mining & Mfg. Co. 8-page illustrated booklet describes on the premises microfilming, film processing, filing, retrieval and reproduction of engineering drawings at IBM Corp. in Poughkeepsie, New York.

DIAZO-MICROFILM 239
Tecnifax Corp. Specification sheet on Diazo-Microfilm for active microfilm systems. Includes density and contrast chart and prices.

READER-PRINTER 240
Documat, Inc. Illustrated catalog sheet describes the Documat microfilm reader-printer for black-on-white enlargements from microfilm in room light. Includes specifications.

MASKED COLOR SEPARATION 226
Gevaert Corp. 4-page illustrated folder describes the 3 in 1 Multimask. Includes diagram of a section of Multimask film and explains the process.

PROCESS COLOR SEPARATOR 227
Durst (USA) Inc. 4-page illustrated leaflet describes the Durst G-139 Process Color Separator. Lists outstanding features and complete technical data.

PARATONE CATALOG 228
Para Tone Inc. 16-page catalog of screens, patterns, and colors available on Paratone sheets. This catalog includes the new conversion charts listing all new numbers which supersede the numbers in all older catalogs.

FILM READER 229
Recordak Corp. 4-page folder gives detailed information on the Lodestar magazine loading film reader.

TYPE AND LETTERING 230
Halber Corp. 44-page catalog illustrates type and lettering available from Typro. Includes formal scripts, modern scripts, square serifs, free styles and outlines and novelties.

LINE-TONE 231
RCS Studios. 6-page folder illustrates the Line-Tone process which converts photographs into line art. Includes specifications and price list.

DRAFTING FILM 232
Chart-Pak, Inc. 4-page illustrated folder describes Futura drafting film on Cronar. Includes characteristics and properties plus a sample of the film.

MASKING FILM 233
Ulano Graphic Arts Supplies, Inc. 4-page folder gives detailed information on Rubylith M3. Includes sample of film.

DO-IT-YOURSELF VISUALS 234
Chart-Pak, Inc. 4-page reprint from *Industry*, "Chart-Pak Builds Expanding Business on Revolutionary 'Do-It-Yourself' Visuals," tells story of Chart-Pak, Inc.

SKIP-TONE 235
Sherfy's Ltd. 4-page illustrated brochure describes Skip-tone, a chemical medium which solves the problems of background tone, unwanted paste-up images on xerographic masters and smudges on preprinted and regular offset masters.

CAMERA LAMP 236
Macbeth Arc Lamp Co. 4-page illustrated folder describes the Macbeth 850 photographic quality incandescent light. Includes specifications and diagram of lamp dimensions.

ARTWORK PREPARATION
Kimberly-Clark Corp. 26-page illustrated booklet *How to Prepare Artwork for Letterpress for Lithography*, includes sections on black-and-white techniques, basic symbols used in marking a press sheet and a section on halftones. Send requests to Kimberly-Clark Corp., Neenah, Wis.

VERTICAL FILES 249
Atlas Stencil Files Corp. Illustrated catalog sheets show Atlas filing units for offset plates, stencils and negatives.

DENSICHRON 250
W. M. Welch Scientific Co. Specification sheet gives full details on the Densichron transmission densitometer series 3835.

MICROFILM RECORDER 241
Regiscope. Illustrated folder describes the Regiscope microfilm recorder and lists some of its uses.

MICRO-FRAME DEVELOPER 242
Kalvar Corp. Illustrated leaflet describes the Kalfax Micro-frame developer. Lists dimensions and electrical requirements and describes the Kalfax process.

PHOTO LETTERING MACHINES 243
Halber Corp. Illustrated folder describes Typro photo lettering machines. Includes samples of type available.

COLOR PRESS 244
Townsend Industries, Inc. 18-page illustrated booklet on the T-51 color press for 1250 Multilith. Entire book is printed on the T-51 Color Press 1250 Multilith combination.

FILES 245
Mim. E. O Stencil Files Co. 4-page illustrated brochure describes files for offset plates and mimeograph stencils and cabinets for copy machines and cuplicators.

COLLATOR 246
Halverson Products Co. Catalog sheet describes the Halverson high-speed, all electric, fully automatic collator.

PUNCH AND BINDER 247
General Binding Corp. Fact book on the Combo punch and binder for plastic binding reports, catalogs, presentations, etc.

SEMI-AUTOMATIC COLLATOR 248
Consolidated Internation Equipment and Supply Co. Illustrated catalog sheet describes the Consolidated 16-station semi-automatic collator for folded sheets. Includes specifications and price.

CUTTERS 258
Royal-Zenith Corp. 4-page illustrated brochure describes the Pivano Royal-Zenith cutters. Includes specifications and price list.

VERTICAL ENLARGEMENT CAMERA 259
Henry P. Korn Associates, Inc. 4-page folder describes the Pismon semi-automatic vertical enlargement camera No. 360. Includes complete specifications.

SYMBOSTAMP 260
John Griffin Co. 4-page folder describes the Symbostamp for printing drafting symbols. Includes illustrations of symbols available.

PHOTOMECHANICAL EQUIPMENT 257
Duothitt Corp. 12-page catalog lists the "professional line" of photomechanical equipment available from this company, including vacuum printers, printing frames, sinks and tables.

GRAFCO EQUIPMENT 261
Graphic Supply Co. 4-page brochure lists Grafco equipment including dot etching tables, vacuum frames, sinks, trays and tilt-top layout table. Includes specifications.

JUSTOWRITER 262
Friden, Inc. 6-page illustrated folder describes in detail the Justowriter for automatic copy-setting. Includes list of accessories, supplies and specifications.

MULTILITH PRECISION ROLLERS 263
Lith-O-Roll. Illustrated folder describes precision rollers available for Multilith Models 1250, 1260, 1275, 1200 and 296.

LITH-O-ROLL PRICE LIST 264
Lith-O-Roll. 4-page price list gives prices of Multilith, Davidson, Whitin and A. B. Dick offset duplicators.

ROBERTSON 480 CAMERA 265
Robertson Photo-Mechanix, Inc. 4-page illustrated catalog bulletin describes the Robertson 480 darkroom camera. Lists standard equipment and complete specifications.

MAGENTA CONTACT SCREEN
Eastman Kodak Co. 24-page pamphlet tells how to use the new Kodak Magenta Contact Screen (for photogravure). Contains a complete section on determining proper exposures including a sample step-by-step exposing procedure with processing instructions. For your copy write to the Eastman Kodak Co., Graphic Reproduction Sales Div., Rochester, N.Y.

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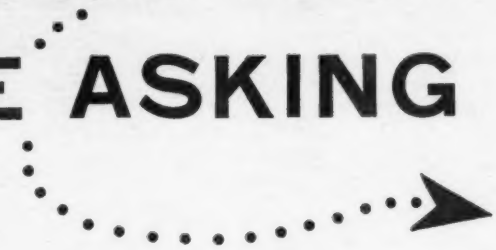

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NEW PRODUCTS

For additional information on any new product circle the appropriate number on the readers' service card, page 47.

PHOTOCOPY PAPER 101

A new projection speed photocopy paper called Tru-Dot, designed to reproduce fine magenta screened film negatives (up to 133 lines), without dot structure deterioration, has been introduced by Peerless Photo Products, Inc. Its application in offset lithography, according to the manufacturer, is such that it replaces the stripping operation with paste-up. This is accomplished by first shooting continuous tone photographs in a process camera on to a film negative using a fine magenta screen. The screened negative is then combined with Tru-Dot in a vacuum frame having an overhead pinpoint light source. After an exposure of about six seconds, the paper is processed in a litho or fine line developer, fixed, washed, and dried. The resulting halftone prints are pasted up on the mechanical as needed. When the paste-up is completed, the entire mechanical with line copy and halftone photographs is shot in a process camera producing a single film negative that can be used to burn-in the offset plate. Tru-Dot is coated on a single-weight, glossy 39 lb. per 1000 sq. ft. baryta coated stock.

OZALID REVERSAL PAPER 102

A negative working, continuous tone, diazo paper that makes postive prints from silver negatives, has been introduced by the Ozalid Div. of General Aniline and Film Corp. Called Reversal Paper (305SR), is is a standard weight, high wet-strength material that produces a deep red image color. For simultaneous exposure-printing-development, the material is fed into a whiteprint machine, in contact with the negative used as the master. After rinsing and drying, the prints are as light-fast as regular positive diazo prints. Ozalid's Reversal Paper is supplied in 10 sheet sizes from 8 x 10½ to 24 x 36 in., with 100 or 250 sheets to a package. It is also supplied by the linear yard in 24, 30, 36, and 42-in. widths.

MODEL A CAMERA MODIFIED 103

The M. P. Goodkin Co. has announced a modification of its Model A Camera. The new features include an adjustable, spring-loaded guide post, flexible Mylar tapes, and a special frame, attached to the camera's lensboard, which encloses the bellows and permits easy release and removal of the entire bellows assembly. The Model A camera can be used for viewing, scaling, and tracing for the production of artwork, as well as for making line and halftone negatives, veloxes, silk screen stencils, photocopies and matrix-transfer masters. It has a 24 x 24-in. focal plate and a 27 x 32-in. copyboard.

HAND EMBOSSING MACHINE 104

The Dymo Corp. has produced a 26-oz. hand embossing machine called the "Dymo-Mite." Featuring a built-in cut-off blade and calibrated tape position indicator, it is designed to give raised letters on a wide variety of ½-in. wide plastic

and metal tapes. One of the features of Dymo plastic tape is that when the letters are embossed, the raised area changes color. This results in great legibility with white letters against a blue, brown, red or green background. Price: $34.95.

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Get more information. Circle 409, page 47

SIMPLIFIED OFFSET

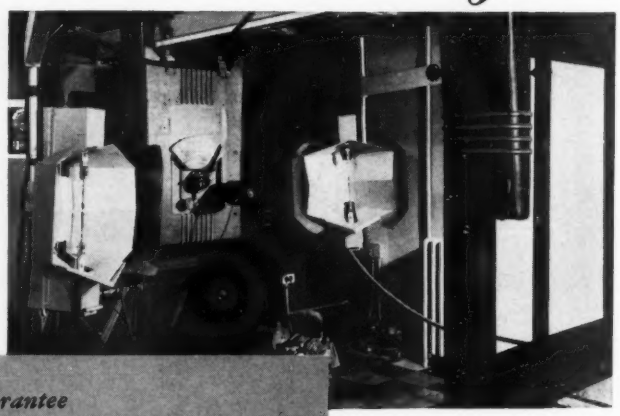
(*continued from page* 43)

lithography. This course concentrates on the *how* and refers you to the text books for the *why*. Two days with the staff of the studio can save the photographer new to halftone color separations many weeks of experimentation. A letter addressed to J. T. Groet, Manager, Graphic Reproduction Technical Service Center, will bring you all the information available on this service.

The following are useful references: *A Simplified System of Color Printing* by H. C. Staehle, in the Proceedings of the 4th Annual Technical Meeting, Technical Association of the Graphic Arts, 1952. *Experimental Low-cost, Short-run Color Printing* by W. Clark, in the Penrose Annual, volume 46, 1952. *A Simplified System of Color Printing. 2. Some Technical Details* by J. A. C. Yule, in the Proceedings of the 5th Annual Technical Meeting, Technical Association of the Graphic Arts, 1953.

Other sources of information are W. L. Rhodes of the Rochester Institute of Technology and Peter Jowise, Consultant, 3184 Lucas Dr., Lafayette, Calif.—THE END

Challenger



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Get more information. Circle 431, page 47

NEW PRODUCTS

(*continued from page* 49)

RAPIDKOTE PLATE **106**

The Polychrome Corp. has introduced a new presensitized plastic-fiber base offset plate for reproduction of simple halftones and line copy. Called Rapidkote, it's said to be engineered to the high-volume user, who demands a fast operating plate for systems applications using photographic negatives. The plate may be exposed in 20 seconds for halftones to 60 seconds for line copy, and can be immediately mounted on the offset press, processed and run.

MICROFILM READER-FILLER **115**

The NB Jackets Corp. has announced the NB Reader-Filler, a machine which views microfilm images at the same time the film is being automatically inserted into notched filing jackets. It permits the operator to feed, insert and cut the microfilm

in a single operation and to verify that the film is going into the correct jacket. Designed for use with NB notched microfilm filing jackets, the Reader-Filler accommodates 100-ft. reels of 16mm or 35mm film.

LIQUID GLOVES **114**

Physicians Formula, Inc., has produced a silicone base lotion with hexachlorophene, called Liquid Gloves, which it claims will protect the hands from water, chemicals, grease, and bacteria. It is available in 3 sizes; 4 oz., 8 oz., and 1 gallon bottles.

CAGEF VERTICAL ENLARGER **163**

Two models of the Cagef vertical enlarger—8 x 10 in. and 10 x 16 in.—with "complete distortion control" have been introduced by Amsterdam Continental Types & Graphic Equipment, Inc. The 10 x 16-in. model offers enlargements to 11X and reduction to 5X with a special 6-in. auxiliary lens. The Cagef features: resetting scales with vernier readings fitted to all moving parts. A suction-type projection board for sizes from 4 x 5 to 20 x 28. Circular contact screens may be fitted to the larger model on a circular mount which adjusts tilt at 15° intervals.

The lamp housing is equipped with a set of superimposed and staggered cold-light, high-intensity tube elements for diffused lighting. Provision has been made for fitting an electronic flash unit.

INSERT FOLDER 119

A machine to automatically fold small package inserts is being distributed by Super Speed, Inc. Called a "Minifolder," it is said to be capable of turning out hundreds of inserts per minute, each one folded as many as eight times. A special feeder can handle any stock, coarse or fine, down to the smallest sizes, the company claimed.

PAPER CUTTER 120

Michael Lith Sales Corp. has announced two new models of the Triumph Manual Office Paper Cutter. One is an 18-in. model which can cut up to 3¼ in. of paper —more than a ream—and can handle as many as 5,000 sheets in 10 minutes.

VISUAL COMMUNICATIONS 161

A Thermo-Fax visual communications system that enables a plastic transparency to be made from almost any document in less than 10 sec. in normal room light and projected immediately in a fully-lighted room has been announced by Minnesota Mining & Mfg. Co. The system employs 8½ x 11-in. plastic projection transparencies that make reproductions in positive, negative or colored form; any existing Thermo-Fax copying machine; and a new overhead projector.

Selling for about 13¢ to 16¢ each, depending upon quantities, the plastic sheets can produce transparencies in a completely dry process from opaque, transparent, or translucent originals.

The new Thermo-Fax overhead projector measures 25⅞ x 13¼ x 21½ in. and weighs 40 lbs. It projects a 10 x 10-ft. image from 15 ft. Price: $395.

VERTICAL COLOR CAMERA 162

Durst, Inc., has announced the G-139, a vertical color camera designed for controlled transparency color separation work. The self-contained unit incorporates registry bars and pins in the carrier and vacuum panel, offering a selection of separation methods. According to the company, a reflex light system minimizes heat to condenser, transparencies and filters; and the lamp housing allows complete control in positioning of the light source to obtain optimum results from use of matched condensers and lenses. The G-139 covers enlargement and reduction of negatives and positives from 35mm up to 5 x 7 in. The light filters are in a drawer located before the optical system.

Two light sources are available with the G-139. One is the Durst Synctrol, which provides a compact panel console with control components for tungsten-type light sources. This includes a Variac for line stability and exposure control and two separately operated timers. One functions as a split second interval timer and the other as an extended timer for litho emulsions.

The second light unit, the Durstronic, is an electronic light source which may be used in place of the Synctrol. This unit is said to offer several distinct advantages including: "better reproduction of straight line curve; short exposures; constant light intensity; simplicity and speed of operation."

NUARC LIGHT TABLE 107

A 23 x 28-in. light table has been introduced by nuArc Co., Inc. Called the LT-23, it has highly-polished, chromed, machine steel straight edge on all four sides; a ceramic glass top; and softly diffused fluorescent light. Price: $99.

SPINNING VACUUM TABLE 108

The Paul Anderson Mfg. Co. has announced the Anderson Spin-Vac spinning vacuum table, designed for the mechanical conversion of continuous tone photography to line reproductions without the necessity of hand or air brush art work. Other uses include making unsharp color correction masks in color separation work; and photo mechanical production of novel and otherwise unobtainable type faces and designs.

FLEXIBOTS 121

Gallon plastic bottles that can be squeezed to force out air, preventing oxidation of photographic chemicals, have been produced by Chari-Vari House. Called Flexibots, they are fitted with air-tight, plastic caps and cannot rust or corrode. Price: $1.50 each, or 3 for $4.

LITHOFILM 118

A duplicate diazo master that enhances weak-line originals has been introduced by the Ozalid Div. of General Aniline & Film Corp. Called Lithofilm (501LC), the product permits direct negative to negative copying in normal room light. It has a .005-in. clear acetate base which is sensitized for dry diazo processing. It is said that the emulsion is completely grainless and highly scratch resistant.

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TESTING FILM BASE STABILITY

by Michael Geary

The changeover in the lithographic industry from wet and dry plates to the many new stable base flexible materials has required the film manufacturer to strive to produce a film base capable of withstanding nearly the same critical size tolerances experienced with the glass negative.

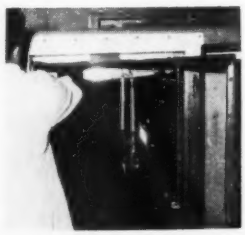
The extent to which extremes various new film bases could be exposed, was the subject for considerable research and testing recently at Army Map Service, the U. S. Army Corps of Engineers mapping installation, with Headquarters and Base Reproduction Plant in suburban Washington, D.C.

Concerning process shrinkage, Clifford P. Chapman, Chief of the Division conducting these tests, told PMI: "The chief problem to be overcome in the maintenance of dimensional stability of photomechanical film is process shrinkage. Process shrinkage is caused by the swelling and contracting of the gelatin on the film base. All gelatins are hygroscopic; that is, they absorb water. When photomechanical film is processed, the gelatin is dry at the time of exposure, swells when immersed in the processing solution, and contracts as it dries. If the bond between the gelatin and the base material is strong, expansion and contraction of the gelatin will cause dimensional changes in the size of the image."

Using specially designed testing chambers, The Development and Test Division, Graphic Arts and Distribution Department, AMS, conducted a series of tests on three quality stable base films to determine "Change due to High Temperature Conditioning," "Change due to Relative Humidity Conditioning," "Change due to Storage Conditioning" and "Change due to Processing." The average allowable size change in color registration for map reproduction at AMS is plus or minus 0.01 in. in 38 in. and this figure was used as a standard in this test.

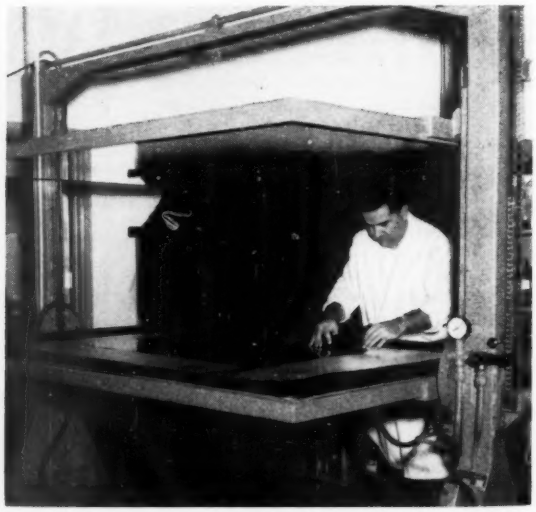
Full size sheet tested

Rather than use the conventional 1 x 10-in. strip of film to predict average results under varying temperature and humidity conditions, AMS prefers the use of a full size 30 x 40-in. sheet, handled under actual production conditions. The stable base films used in the latest AMS tests were on .007 polyester base furnished by three different well-known film manufacturers. The procedure for testing was as follows: **A** Measure and record the size of a master glass positive plate, used as



Humidity chamber

Measuring image



Stable base negative is placed on coated metal plate

original copy. All measurements to be made with LTF Register Rule. **B** Make three contact negatives from the master plate on each of the films to be tested. **C** Allow all nine negatives to hang for 24 hours. **D** Take temperature and relative humidity readings at least three times during the 24 hour drying period. **E** Average the temperature and relative humidity readings. **F** Make a metal press plate from each of the nine negatives. (Mark one film sheet from each source as K-1, A-1 and C-1 before making initial plate exposure.)

Test No. 1—Place negatives K-1, A-1 and C-1 in humidity chamber for 18 hours at 160°F and 10 per cent RH. Remove negatives from chamber and expose second image on plates K-1, A-1 and C-1 respectively. Allow negatives to rest at room temperature and humidity for 24 hours, taking temperature and relative humidity readings at least three times during this 24 hour period. Average the temperature and relative humidity readings. Make a third exposure to plates K-1, A-1 and C-1 respectively. Measure image of three exposures and record. The Difference between third image and glass plate size is "change due to *high temperature* conditioning." Difference between first image and glass plate size is "change due to *processing.*"

Test No. 2—Mark one sheet of film from each source as K-2, A-2, C-2 and D-2 respectively before making initial press plate exposure. Steps **C** and **D** of procedure for testing having been applied, place negatives K-2, A-2 and C-2 in humidity chamber for 18 hours at 103°F and 99.5 per cent RH. Remove and expose second image on plates K-2, A-2 and C-2 respectively. Allow negatives to rest at room temperature and humidity for 24 hours, taking temperature and relative humidity readings at least three times during this 24 hour period. Average the temperature and relative humidity readings. Make a third press plate exposure on plates K-2, A-2 and C-2 respectively. Measure and record size of image of these three exposures. The difference between third image and glass plate size is "change due to *high relative humidity* conditioning." Difference between first image and glass plate is "change due to *processing,*" and should equal the same as that obtained in the same phase of Test No. 1.

Test No. 3—Mark one sheet of film from each source as K-3, A-3 and C-3 respectively before making initial press plate exposure. Steps **C**

(*continued on page* 54)

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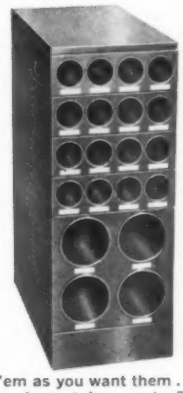

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STABILITY TEST

(*continued from page* 53)

and **D** of procedure for testing having been applied, place negatives K-3, A-3 and C-3 in the humidity chamber for 18 hours at 85°F and 90 per cent RH. Remove and expose second image on plates K-3, A-3, C-3 and D-3. Allow negatives to rest at room temperature and humidity for 24 hours, taking readings as in previous tests. Make third plate exposure on plates K-3, A-3, C-3 and D-3 measuring and recording size of images. The difference between third image and glass plate size is "change due to *storage* conditions." Difference between first image and glass plate is "change due to *processing*" and should equal the same as that obtained in the same phases of Test No. 1 and No. 2.

The requirements placed upon Corps of Engineer mapping organizations are such that some field units charged with the hasty reproduction of multi-colored maps, may very easily be located in areas where extreme climatic conditions prevail. Therefore, it must be understood that the testing of lithographic film as well as other material and equipment, are part of a continuing program to evaluate and arrive at findings that may be applied in field use as well as in ideal plant conditions. The prime purpose for the testing reported here was to provide information to the researchers on high temperature, high humidity and storage conditions, in addition to the ever-present change due to processing. Three polyester films provided by three major manufacturers were used for these tests and although each showed some different reaction when exposed to the various tests, no attempt will be made here to determine which film has reacted most favorably to all tests. All film tested did meet the minimum requirements of AMS standards, well within the figure of plus or minus 0.01 in. in 38 in.—THE END

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SUBURBIA

(*continued from page 25*)

Even with the additional equipment, the camera and the reader-printer, four rooms have been cleared of old files by the system and the records are at once more quickly accessible and more secure. Original microfilms are never touched, and they never leave the records library.

Outside of the medical librarians at Meadowbrook, who are technically under Ward's jurisdiction, the microfilm department comprises a chief microfilm operator, a senior microfilm operator and seven microfilm operators. All vacancies are filled by appointment, but appointees are required to take and pass a test given by New York State Civil Service after a given length of time. The grades are 7 to 15, encompassing a salary range from $3460 to $6380 annually.

The major equipment in the microfilming department comprises: two 16mm Bell & Howell Model 190E Recorder (flow) cameras, four model D Kodagraph and two Model D Recordak cameras, a Model BC22 Houston-Fearless processor (35mm) and one Bell & Howell Model BH192A (16mm) processor, a Model A Recordak enlarger and six film readers.

Quality checks include reading background density of each processed roll, proofreading each roll for skips and bad exposures, checking for physical damage and inspecting random frames on a reader for clarity throughout the image. Samples of processed film are sent each month to the manufacturer who provides chemicals on contract. He sends back a report on residual silver and residual hypo in the film. As a result of such a report early in the game, the temperature of the wash water was substantially increased (about 10°F) to guarantee better hypo elimination.

Besides their current necessity, the records filmed by the Nassau County microfilm group are the makings of history. Not only is archival quality maintained, but the plan of microfilming itself is something that has to be made with future history books in mind. For this reason Ward keeps in touch with archivists in the State University of New York.

Ward's guess is that records are going to get smaller and smaller as the wonderkind of suburban communities keeps bursting its seams.—THE END

BROOKLYN BRIDGE

(*continued from page 36*)

positive suitable for reproduction.

These two images—the pattern of dots and the line postive—were sandwiched in register and enlarged to approximately final size.

An artist pasted a proof of the type copy in place on the photograph to make the mechanical for one of the four final colors used.

The art for each subsequent color was applied to an acetate overlay registered to the photographic print. In every case it consisted of a pattern of dots similar in technique to the original vellum overlay.

The finished artwork, ready for the silk screen house, thus consisted of a photographic print plus three manually done acetate overlays. Neither photomechanical color separation nor halftone screening were required. The use of photography in preparing the art saved the artist a good deal of time.

The finished job, ready for mailing, has been accomplished at minimum cost because the colors have been separated for the printer. Halftones have been eliminated since the completed image is already in dot form.—THE END

PLATEMAKING SHORTCUTS

(*continued from page 31*)

ducing more plates faster unless they can be printed. We have a number of 1250 Multilith presses which are not the fastest in the world. Several of these have been converted by the use of speed-up kits to 11,000 impressions per hour. We had a few problems at first but these have all been resolved, and we now use these presses for all text or line drawing pages. The Multilith speed-up kit is only a larger motor pulley and a new drive belt. By this method we keep the same ratio of speed adjustment, but increase the maximum and minimum speeds available.

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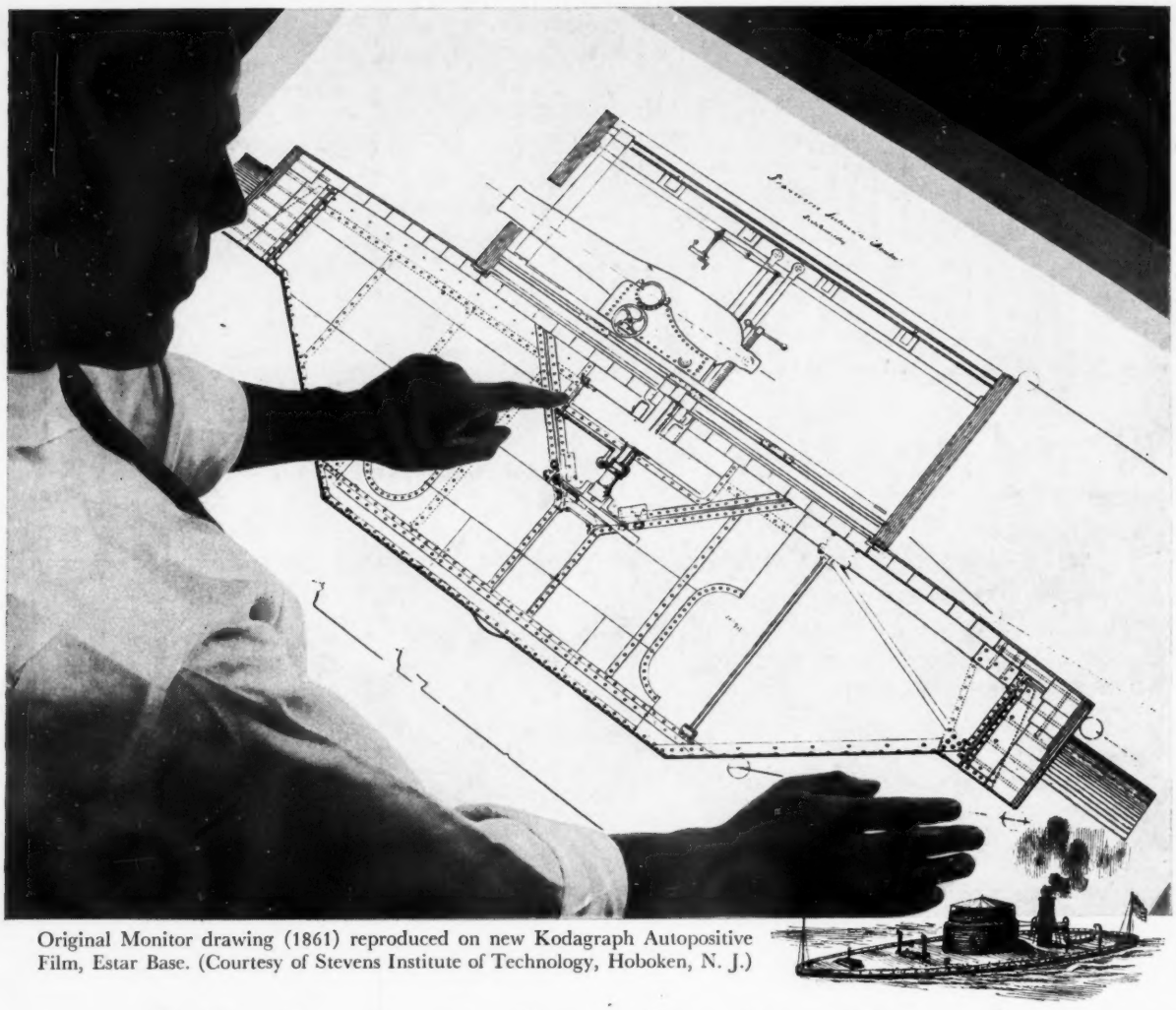

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